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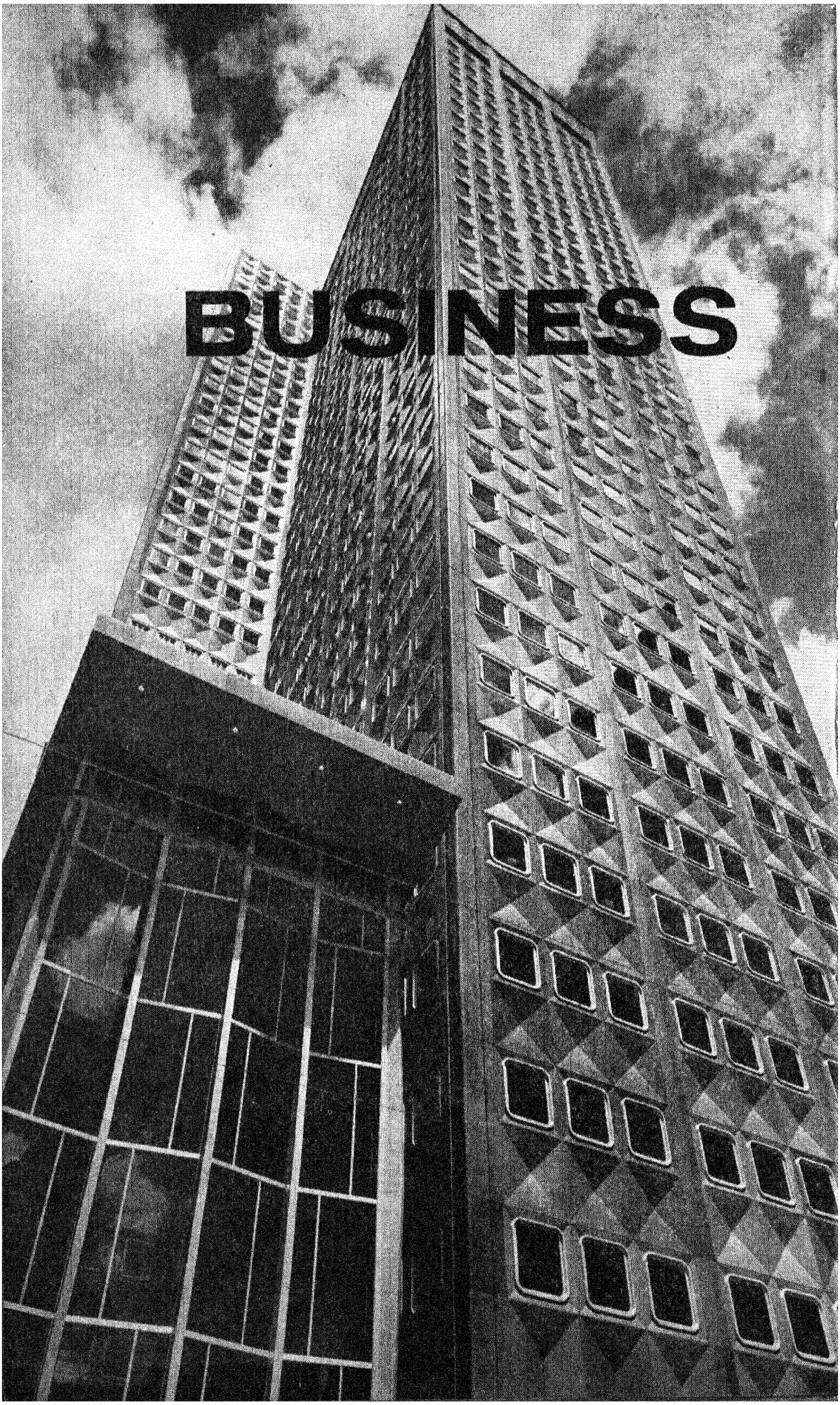

BUSINESS

ARITHMETIC

FOURTH EDITION

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FOURTH EDITION

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PREFACE

The first question that a business man asks an applicant for a clerical job involving any kind of computation is, "Can you add, subtract, multiply, and divide accurately and with reasonable speed?"

If the young person can meet this requirement, the employer expects him to have the ability to apply this skill to more or less simple processes involving interest, insurance, payrolls, discounts, commissions, invoices, and other business situations.

The revision of this book is based on the assumption that fundamental processes come first and their application second. The authors also believe that there is a close correlation between the personal problems of the individual and the problems of business. Therefore, if interest is to be stimulated, the reader must first be able to find answers to his own problems as an incentive to solving the problems of business.

In addition to the broad objective stated, the book contains other aims and special features designed to increase skills in business computation:

1. An introduction to arithmetic through learning to read.
2. A survey test of fundamentals.
3. Adequate speed drills for maintenance of skills in fundamental processes.
4. Short cuts in the manipulation of whole numbers, fractions, and decimals.
5. Units of assignable length.
6. Examples for every type of exercise.
7. A logical transition from common fractions to decimal fractions through aliquot parts.
8. A review test for every chapter.
9. Many applications to business situations through the use of forms, illustrations, and problems.
10. Groups of problems arranged in the order of increasing difficulty for adaptation to the slow learner as well as to the advanced student.

Finally, the reader will gain added interest in business arithmetic because of the new treatment of interest and banking, the different approach to credit, the modern conception of costs in automobile purchase and operation, the practical problems in owning and maintaining a home, and the up-to-date treatment of social security taxes, unemployment insurance, and payroll accounting.

A. E. McNelly
L. J. Adams

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Chapter 1

Introduction

The Importance of Business Arithmetic to the Individual and to Business

BUSINESS ARITHMETIC is practically the same if used by an individual in figuring his income tax or by a business in performing the same operation. The fundamental processes of addition, subtraction, multiplication, and division of whole numbers, fractions, and decimals are the same in both cases.

Making out a budget, borrowing money, writing checks, operating an automobile, maintaining a building, paying taxes, buying insurance, estimating profits, figuring discounts, and many other business activities use the same fundamental arithmetical calculations whether they apply to an individual or a business.

Businessmen and their employees who are engaged in buying and selling, in manufacturing, and in service enterprises are constantly using arithmetic. A retail merchant uses it in calculating the capital he needs to start a business, in deciding how much rent he can afford to pay, and in figuring the cost of the merchandise he is ordering. When he goes to his bank to borrow money with which to pay bills before they are due so that he can earn a discount, the amount for which he will ask has been determined with the use of arithmetic. After he has purchased merchandise, he must set a selling price, and once again arithmetic comes to his aid in figuring his cost, his expenses, and his desired rate of profit.

The manufacturer, too, is constantly using his pencil in like fashion. Since he buys raw material and turns it into a finished product, he is also confronted, as is the retailer, with deciding how much to pay for his purchases, how much to pay his employees, the rent he can afford, the cost of his advertising, and a thousand other similar details. Without the use of arithmetic, these calculations would be impossible.

Things which are made must be sold, and the business world employs salesmen or sales agencies to perform this task. A very large part of this is done on what is called a *commission basis;* that is, the salesman's income is determined by the amount he sells, and it is obvious that both the employer and the salesman need arithmetic to compute the amount to be paid. Insurance brokers, real estate agents, brokerage houses, and commission agents are others whose income is determined on a commission basis; they, too, need arithmetic.

The banker deals in money, accepting money for deposit and investing part of it in securities and lending other parts to businessmen. Naturally, before he can tell a borrower how much interest will have to be paid for a loan, he will have to resort to arithmetic in determining the amount.

UNIT 1

Habits and Attitudes in the Study of Arithmetic

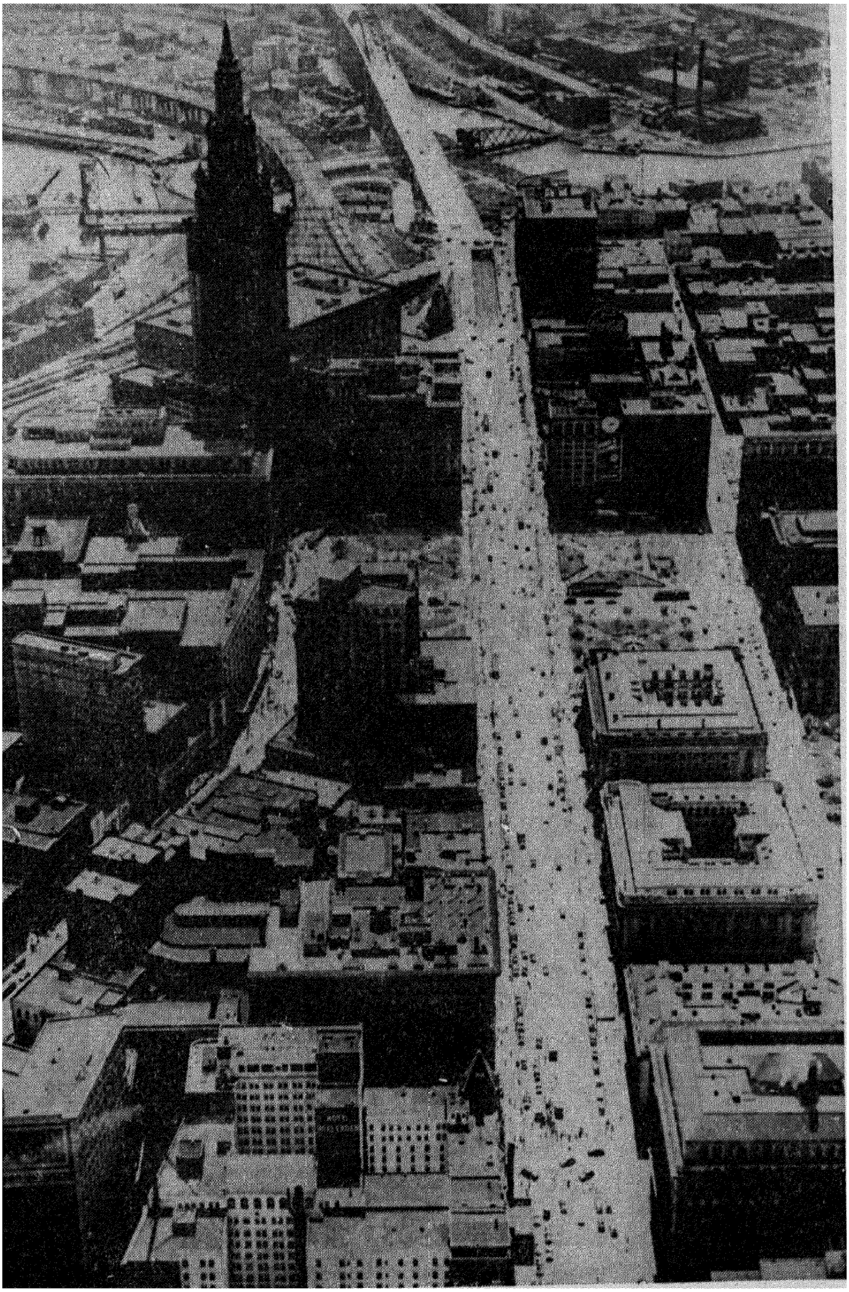
General reading skills. Some general reading habits that you should acquire apply to the reading of most school texts as well as to the reading of arithmetic. You should always keep in mind that you are reading, first, to understand what you are reading, and second, to remember what you are reading.

The following are good habits to have when reading study-type material:

1. Never read too fast to understand what you are reading.
2. Don't be afraid to reread.
3. Pause at the end of every paragraph. Attempt to repeat what you have just read without referring to the material.
4. Look for the important words. Sometimes they are printed in italics.
5. Select the important facts. Learn to disregard the nonessential ones.
6. Use the dictionary.
7. If possible, know before you read what you are supposed to find.
8. Summarize in your own words whenever possible.

Attitudes in the study of arithmetic. The following list contains good attitudes which will help you to succeed:

1. I can master the subject if I work at it.



A Large City. All types of business are represented in this picture: factories, offices, retail and wholesale establishments, transportation, and public services.

2. I know that the skills which I shall acquire will help me in business and in private life.
3. I cannot afford to be ignorant of the commonly used mathematical terms found in magazines and newspapers.
4. The study of arithmetic gives me power to think independently.
5. It compels hard thought.
6. It trains me to be exact.
7. It trains my mind to be logical.

The following attitudes will help you to fail. Avoid or try to overcome them:

1. I never could get arithmetic.
2. I just don't like it.
3. What good is it?
4. I always make mistakes.
5. I never know whether to add or subtract.
6. It is too hard for me to understand.

Good Habits to Be Developed in the Study of Arithmetic

Many of the principles of study apply directly to the study of arithmetic. How many of the following good habits have you developed?

1. Knowing exactly what is to be done.
2. Having a clear idea of how the problem is to be solved.

✓ 3. Being neat in all written work.
✓ 4. Always being as accurate as possible.
✓ 5. Correcting errors.
✓ 6. Copying figures accurately.
✓ 7. Arranging work in orderly form.
✓ 8. Using short cuts.

UNIT 2

How to Read Arithmetic

Because most of the material to be read in arithmetic books is concentrated information, the rate must be very slow. Every word must be given attention. It is said that when reading requires thinking, it is study. If this is true, then all reading of arithmetic is study. It should be emphasized, too, that one reading is rarely ever sufficient. Problems should be read and reread.

Purposes in reading. One should always read with a definite purpose or purposes in mind. Introductions to new units or new types of problems contain information necessary to the understanding or solving of these units or problems. Our purposes in reading these introductions are as follows:

1. To understand what we are reading.
2. To select the important words.
3. To be able to define these key words.
4. To apply what we have learned to the problems that follow.

Let us apply these purposes to the following paragraph which is found later in the book:

Business concerns employ salesmen to sell their merchandise. In the same way, property owners who wish to sell their real estate employ *real estate brokers.* These brokers are licensed by the state, and the commission rates which they are permitted to charge are regulated by law. Rates vary in different localities. In one large city, for example, on sales up to and including $100,000, the commission rate is 2½%; from $100,000 to $1,000,000, the rate is 1½%; from $1,000,000 to $2,000,000, the rate is 1¼%; and over $2,000,000, the rate is 1%. Outside of the city, the commission is usually 5% on small sales. The seller, and not the buyer, pays the commission.

Problem

A broker sells $1,500,000 worth of real estate in one year. What is his commission?

Answer the following questions:

1. Under what general subject would you place the paragraph?
2. What is a real estate broker?
3. How are these brokers regulated?
4. Are rates always the same?
5. What fact from the paragraph would be used in solving the problem?

Study Helps in Mathematics

The following suggestions may help you in solving your problems:

1. Read all introductory material carefully.
2. Write figures plainly.
3. Make drawings and diagrams whenever possible. They help you to visualize the problem.

4. Label all results. If they are in dollars and cents, write the dollar sign; if the answer is in number of feet, write *feet* after the number; if the number represents interest at 6% for 60 days, write *Interest at 6% for 60 days.*
5. Always prove your work. Everyone makes mistakes.
6. Don't give up if you cannot solve the problem on the first attempt. Try some other method.

UNIT 3

Vocabulary and Comprehension

THE SIZE OF your vocabulary is an important factor in your ability to comprehend what you read. Even more important than your general vocabulary in the study of a subject is your knowledge of the special terms used in that subject.

Test the size of your business arithmetic vocabulary by placing a check in front of the terms with which you are familiar.

ad valorem
aliquot
annuity
appraisal
assessment
assets

balance
beneficiary
benefits
bill of exchange
bill of lading
bond
broker
budget

cancellation
certificate
code
coinsurance
commission
common stock
consignee
consignment
consignor
co-operative
corporation
cost-plus
coupon

deduction
depreciation
discount
dividends
drafts

enclosure
endowment
equation

factor
front foot

graph
gross cost
guarantee

indorsement
installment
interest
inventory
invoice

ledger
letter of credit
liability
liquid
list price

maintenance
margin
markdown
marketing
markup
maturity date
memorandum
metric
mortality table
mortgage
multiplicand

negotiable
net proceeds
numerator

partnership
per cent
piecework
policy
preferred stock
premium
principal

proportion

quote
quotient

ratio
receipt

redemption value

social security
straight line
subtrahend

UNIT 4

Reading and Interpreting Problems

In reading and interpreting problems, you have the following very definite purposes:

1. To find the facts necessary to solve the problem.
2. To determine what is to be found.
3. To determine the processes to use.
4. To estimate the answer.
5. To find the true answer.
6. To check the accuracy of the answer.

Example: Bill bought a compact for his mother's birthday gift. The price was $9.95. In addition, he paid 20% Federal Tax and 3% state tax. What did the compact cost him?

1. The necessary facts to solve the problem:
   a. Original price of compact.
   b. % of Federal Tax.
   c. % of state tax.
2. What is to be found:
   Total cost of compact.
3. Processes to use:
   a. Multiply to find amount of Federal and state taxes.
   b. Add to find total cost.
4. Estimating the answer:

   20% or $\frac{1}{5}$ of $10.00 = $ 2.00
   3% of $10.00 = .30
   Price of compact = 10.00
   $12.30 total estimate

5. Finding true answer:

   20% of $9.95 = $ 1.99 Federal Tax
   3% of $9.95 = .30 state tax
   9.95 price
   $12.24 total price of compact

6. Checking the results:
23% of $9.95 = $ 2.29
9.95
$12.24 total price

Problems

Read the following problems and follow the steps outlined in the example for each problem.

1. A train traveled 390 miles in 6½ hours. Find the average speed of the train.

2. How many cubic feet of earth must be removed in excavating a cellar to a depth of 10 feet if the building is to be 60 feet long and 48 feet wide?

3. A kitchen is 10 feet long and 8½ feet wide. How many square feet of linoleum are required to cover it?

4. James weighs 87 pounds. John weighs 8 pounds more than James. Mary weighs 85 pounds. How much more does John weigh than Mary?

5. Mr. Simpson purchases a car for $1200. He pays $380 in cash and the balance in 12 equal payments. How much is each payment?

6. A test contains 24 problems. Susan worked 18 of them correctly. What was her grade in per cent?

7. Mr. Oldham in one month made the following deposits in the bank: $175, $220, $168.75. He withdrew the following amounts: $65, $25, $85.40, $16.20. What was his balance at the end of the month?

8. Mr. Benson borrowed $1200 at the bank for one year at 6%. The loan was to be paid back in equal quarterly payments with interest. How much was the interest on each payment?

9. George Lims is paid $1.80 per hour for a 40-hour week. One week he worked 48 hours. He received time and a half for overtime. What were his wages for the week?

10. A dealer was quoted 10 stoves for $89.50 each and 15 refrigerators for $169.50 each. He was given a 20% discount on the stoves and a 25% discount on the refrigerators. What was the total cost of the two purchases?

UNIT 5

Survey Test of Fundamentals

THE FOLLOWING test should help to determine how much practice you need in the manipulation of whole numbers, common fractions, decimal fractions, denominate numbers, and percentage.

This test is timed because it is important to know how rapidly you can calculate as well as how accurate you are. Both factors are important in the business world.

DIRECTIONS: Make an answer form before you begin. Copy as few of the problems as necessary. Reduce all common fractions to lowest terms. You will be given 35 minutes to work as many problems as possible.

Problems

1. *Add:* 589
346
738
592
619

2. *Subtract:* 61,866
12,978

3. *Multiply:* 435
704

4. *Divide:* 56)4704

5. *Add:* $2\frac{1}{5}$
$3\frac{3}{10}$
$1\frac{5}{20}$

6. *Subtract:* $\frac{5}{9} - \frac{1}{3}$

7. *Multiply:* $\frac{1}{3} \times \frac{1}{6}$

8. *Divide:* $15 \div \frac{3}{5}$

9. *Change to a mixed number:* $\frac{9}{2}$

10. *Add:* \$34.50 + \$11.20 + \$13.80

11. *Subtract:* \$453.46 − \$264.58

12. *Multiply:* 30.5 × .006

13. *Divide:* 9 ÷ .003

14. *Add:* 6 qt. 1 pt.
8 qt. 1 pt.

15. *Subtract:* 8 hr. 30 min.
4 hr. 40 min.

16. *Multiply:* 8 lb. 6 oz.
4

17. *Divide:* 4)15 yd. 7 ft.

18. What number has the greatest value: .4, .44, .444?

19. Round off to nearest tenth: 14.09

20. Change $\frac{1}{2}$ to a decimal.

21. Change .80 to a common fraction.

22. Change .28 to a per cent

23. Change $37\frac{1}{2}\%$ to a decimal.

24. Change $\frac{1}{3}$ to a per cent.

25. Change 75% to a common fraction.

26. *Add:* 74 + 80 + 6 + 35 + 7

27. *Subtract:* 16,427
8538

28. *Multiply:* 456
38

29. *Divide:* 68)5372

30. *Add:* $3\frac{1}{2} + 4\frac{1}{6} + \frac{5}{12}$

31. *Subtract:* $8\frac{3}{8} - 4\frac{5}{6}$

32. *Multiply:* $\frac{1}{2} \times \frac{1}{4} \times 2\frac{1}{6}$

33. *Divide:* $1\frac{1}{2} \div 4\frac{2}{3}$

34. *Change to improper fraction:* $4\frac{2}{3}$

35. *Add:* 3.7 + .9 + .06 + 8.042

36. *Subtract:* 16 − 3.017

37. *Multiply:* .145 × .27

38. *Divide:* 12.375 ÷ 5.5

39. *Add:* 4 yr. 6 mo.
3 yr. 8 mo.

40. *Subtract:* 5 ft. 8 in.
2 ft. 10 in.
2 ft 10 in

41. *Multiply:* 3 doz. 5 units
6
20 doz 6 units

42. *Divide:* 2)5T. 600 lbs.

43. What number has the greatest value: .35, .305, .356? ✓

44. Round off to the nearest hundredth: 16.299 16.30 ✓

45. Change $\frac{5}{16}$ to a decimal.

46. Change .0625 to a common fraction. 1/16

47. Change .005 to a per cent

48. Change $\frac{1}{4}\%$ to a decimal.

49. Change $\frac{1}{6}$ to a per cent.

50. Change $206\frac{1}{4}\%$ to a mixed number.

Do you need practice?

Excellent	*Good*	*Fair*	*Poor*
Above 45	41–45	37–40	36 or less

Chapter 2

Whole Numbers

UNIT 1

Addition of Whole Numbers

Speed and accuracy. Speed and accuracy are necessary in all business computation. In addition, speed and accuracy are especially important because addition is used more often than the other processes. Actually, there are only 100 different number combinations in addition. They should be learned thoroughly.

Accuracy is of the utmost importance in business. Mistakes are costly not only to the businessman, but eventually to the employee, who may lose his job because of them.

The Austin Company

A Modern Business Office. Employees in modern business offices must be able to add, subtract, multiply, and divide with speed and accuracy.

Methods of Checking Results in Addition

EXAMPLE: During the week ending Mar. 15, ten salesgirls in a department store sold the following quantities of dress goods: No. 1, 1288 yd.; No. 2, 1376 yd.; No. 3, 1698 yd.; No. 4, 1149 yd.; No. 5, 1774 yd.; No. 6, 1499 yd.; No. 7, 1383 yd.; No. 8, 2467 yd.; No. 9, 2582 yd.; No. 10, 1967 yd. Show how the manager finds the total number of yards sold, proving the answer either by adding in reverse order or by using the accountants' method.

To determine the sum of the yardages sold, the manager lists in column alignment the quantities sold by the ten girls, being certain that he copies the figures correctly and that he places each number directly under the preceding one.

His solution on paper looks like this:

SOLUTION.

$$\begin{array}{r} 1288 \\ 1376 \\ 1698 \\ 1149 \\ 1774 \\ 1499 \\ 1383 \\ 2467 \\ 2582 \\ 1967 \\ \hline 17{,}183 \end{array}$$

PROOF. *Adding left to right:*

$$\begin{array}{ccccc} 1 & 2 & & & \\ & 4 & 4 & & \\ & & 7 & 2 & \\ & & & 6 & 3 \\ \hline 1 & 7, & 1 & 8 & 3 \end{array}$$

Adding right to left:

$$\begin{array}{ccccc} & & & 6 & 3 \\ & & 7 & 2 & \\ & 4 & 4 & & \\ 1 & 2 & & & \\ \hline 1 & 7, & 1 & 8 & 3 \end{array}$$

He adds from bottom up and proves the result, not by *adding in reverse order*—that is, from top to bottom, but by the accountants' method.

Accountants' method. In proving the answer by the accountants' method, the manager is enabled to resume the work where it is left off in case he is interrupted after having added one or more columns. This method works as follows: Each column is added in turn, and the totals are placed in staggering positions from left to right or from right to left, as shown in the proof of the example.

Problems—Group 1*

Add, applying to each problem one of the methods of checking explained:

1. 1642
7824
9268
7327
4864
3924

2. 4261
3429
8264
5962
3847
2925

3. 1728
2847
6321
9264
2427
1675

4. 7926
2927
8429
3728
7264
3176

[illegible]

5. 2496
3921
8427
6924
3728
8764
3925
8267
1476
2971

6. 7824
9265
3786
4297
3142
8764
9265
7342
1248
3792

7. 2874
8765
9267
2743
1428
8726
2342
7926
3925
2742

8. 7295
3164
6927
8426
2972
3728
8742
2926
3874
1429

9. 8926
4928
1567
3824
2786
7643
5287
2761

10. 36,281
27,846
39,467
28,246
34,821
76,420
28,473
92,164
78,321
84,263

11. 41,426
22,340
80,726
72,528
34,372
91,564
58,621
72,564
37,826
76,518

12. 43,724
59,627
32,846
73,921
28,724
59,267
28,742
93,564
73,862
37,924

13. 142,962
167
3928
72
376
9264
28,776
927,842
17,641
928

14. 12.64
128.76
3.84
192.87
5762.77
729.44
34.29
147.80
28.00
3762.43

[illegible]

15. 96.20
172.45
5.86
.74
312.50
92.64
7.37
18.60
378.00
58.92

16. 578.42
5.76
93.42
278.47
2496.28
378.49
9.27
87.62
374.81
3976.43

---

* In the long tabular problems, do not copy the figures, but place a small slip of paper under the column and write the result on this slip. After you have proved your answer, write it on your practice paper.

GROUP 2

1. The daily sales for one week in a grocery store were as follows: Monday, $152.40; Tuesday, $268.25; Wednesday, $142.56; Thursday, $327.86; Friday, $478.38; Saturday, $824.79. What were the total sales for the week?

2. The number of telephones in five cities in one district were 48,503, 36,041, 59,320, 38,998, and 30,144. What was the total number of telephones in the five cities?

3. In successive months, a businessman drove his automobile the following number of miles: 3079, 2990, 2781, 2745, 2685, 2588, 1498, 1423, 1220, 540, 874, 1720. How many miles did he drive during the year?

4. A firm made the following cash deposits at the bank during the week: $687.42, $537.28, $1273.50, $749.68, $2547.88, $2336.49. What was the total cash deposit for the week?

5. The following numbers of pounds of produce were sold by a commission merchant to one customer: 91 pounds of tomatoes, 239 pounds of potatoes, 206 pounds of peas, 258 pounds of apples, and 204 pounds of peaches. Find the total number of pounds of produce sold.

6. A farmer made the following deliveries of milk to the creamery in one week: 160 lbs., 220 lbs., 180 lbs., 190 lbs., 175 lbs., 215 lbs., and 165 lbs. What was the total amount delivered in that week?

7. A department store had the following sales one week: Clothing, $1128.40; Shoes, $984.75; Groceries, $548.30; Notions, $235.60; Miscellaneous, $826.45. What were the total sales for the week?

8. In one day, an oil company made six deliveries of gasoline as follows: 1000 gallons, 750 gallons, 675 gallons, 450 gallons, 875 gallons, and 950 gallons. What was the total number of gallons of gasoline delivered on that day?

9. The number of automobiles registered in each of five different states was 596,846; 240,359; 434,395; 4,161,109; 510,222. What was the total registration in all five states?

10. The following quantities of goods were imported to the United States in a certain year:

Coffee	1,808,000,000 lbs.
Sugar	6,092,000,000 lbs.
Fish	346,000,000 lbs.
Wood pulp	2,128,000,000 lbs.
Newsprint	5,562,000,000 lbs.

Find the total number of pounds of these imports for the year.

UNIT 2

Addition Used in Business—Records of Sales

1. Find the totals and grand total:

Department	*Sales*						*Total for Week*
	Mon.	*Tues.*	*Wed.*	*Thurs.*	*Fri.*	*Sat.*	
Grocery...............	$ 84.90	$ 98.30	$ 87.40	$102.10	$127.50	$185.67	
Shoe................	107.00	121.50	89.40	112.00	137.25	216.75	
Furniture..............	208.00	312.70	215.90	187.35	275.00	372.00	
Rugs and Carpets......	212.00	172.80	287.00	375.40	188.90	295.00	
Clothing...............	175.00	290.00	285.00	317.60	298.70	462.20	
Suits and Coats........	128.40	192.80	247.00	312.30	360.50	478.00	
Totals............							

2. Complete the following record of sales:

Day	*Furniture*	*Tableware*	*Linen*	*Total*
Monday..................	$ 324.80	$272.60	$184.95	
Tuesday..................	273.60	312.80	327.45	
Wednesday................	672.45	237.60	248.90	
Thursday.................	711.50	371.45	188.20	
Friday....................	316.35	288.60	342.15	
Saturday..................	1124.50	431.70	583.25	
Totals...............				

3. Complete the following record of sales:

Salesmen's Sales of Silk Stockings for April, May, and June

Salesman	*April*	*May*	*June*	*Total*
E. H. Case.................	$245.60	$312.50	$411.20	
O. E. Moore................	221.30	415.20	503.12	
A. H. Berch................	311.15	241.16	423.30	
J. H. Hooker...............	610.22	543.30	452.21	
M. A. King................	334.12	221.23	434.15	
Totals................				

4. Find the totals as indicated:

SENTINEL DEPT. STORE, SALES DISTRIBUTION BY DEPARTMENTS

Invoice No.	*Dept. 1*	*Dept. 2*	*Dept. 3*	*Dept. 4*	*Total*
749	$ 28.32	$ 16.85	$ 12.58	$ 7.75	
750	122.64		185.47	322.98	
751		48.50	162.73	99.46	
752	228.63	172.47		185.75	
753	68.40	72.94	38.61	118.33	
754	182.90		167.18	143.91	
755	18.32				
756	145.55	218.46	119.27		
Totals					

5. Find all of the totals indicated:

WEEKLY PAYROLL SUMMARY
CRANE COAL COMPANY

Name	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*	*Saturday*	*Total*
Criswell, J.	$12.20	$12.20	$10.40	$ 8.60	$12.20	$6.10	
Deman, N.	11.35	9.60	9.95	13.20	13.40	7.80	
Deetz, O.	9.75	8.55	10.30	7.60	10.25	5.20	
Edge, V.	12.75	9.45	11.65	10.80	11.20	6.45	
Garde, E.	13.20	11.42	10.85	9.65	12.20	6.80	
Helby, C.	12.10	11.40	12.10	11.60	10.90	5.45	
Koss, A.	8.20	7.60	9.45	9.65	8.25	4.30	
Pross, M.	12.40	13.10	11.60	10.80	11.45	6.20	
Totals							

UNIT 3

Horizontal Addition

Ability to add horizontally is important in many business problems involving billing, payrolls, and statistical tables of all kinds. It also serves as an accurate check on vertical additions.

EXAMPLE:

$$\begin{array}{l}
17 + 24 + 15 + 35 + 46 = 137 \\
15 + 34 + 28 + 44 + 57 = 178 \\
24 + 15 + 37 + 28 + 46 = 150 \\
16 + 25 + 24 + 38 + 12 = 115 \\
\underline{25} + \underline{14} + \underline{32} + \underline{72} + \underline{14} = \underline{157}
\end{array}$$

Adding horizontally may be done more readily without rewriting the numbers in vertical columns by using multiples of ten or hundreds as much as possible. For example, in adding the first horizontal line in the example, one will say, "17, 21, 41–46, 56–61, 91–97, 137."

Add the following problems horizontally:

1. 6 7 5 4 2 8 3 ____
5 4 9 3 8 2 7 ____
7 8 6 2 7 6 5 ____
8 7 4 9 8 7 6 ____
4 3 7 8 6 9 9 ____
9 8 2 7 5 3 4 ____
3 4 8 5 7 5 6 ____

2. 8 16 3 9 6 5 7 ____
11 9 10 4 11 9 12 ____
6 14 6 18 9 14 5 ____
9 12 15 6 14 7 13 ____
14 4 12 13 8 13 4 ____
10 8 11 7 12 8 19 ____
7 19 5 17 3 16 6 ____

3. 17 23 15 28 16 30 18 ____
24 16 26 17 28 19 29 ____
18 35 23 19 27 25 12 ____
32 14 24 26 18 17 26 ____
45 21 35 14 23 24 15 ____
13 18 27 23 33 12 19 ____
27 22 19 31 16 24 18 ____

4. 24 17 32 16 22 11 37 ____
16 23 19 25 13 31 24 ____
32 18 26 12 21 14 27 ____
17 33 14 28 15 25 15 ____
21 30 16 18 24 26 19 ____
10 25 33 12 16 27 17 ____
28 11 29 25 19 34 12 ____

Practice Test in Addition

1. 39
95
18
37

2. 78
23
14
58

3. 61
53
89
42

4. 20
93
26
78

5. 61
54
69
28

6. 214
803
340
775

7. 161
951
578
718

8. 572
326
137
359

9. 122
945
368
718

10. 684
637
125
960

11. $51.37
87.38
39.45
10.35
27.33

12. $27.21
31.54
61.45
23.57
50.25

13. $85.24
15.75
23.94
93.89
71.84

14. $78.49
39.25
62.73
12.58
51.98

15. 58,480
78,083
12,120
58,784
76,763

16. 39,276
46,326
89,858
96,124
85,615

17. 72,195
63,827
90,384
39,470
79,386

18. 43,635
28,268
14,956
93,547
67,196

Add horizontally and vertically, proving results by adding totals:

19.	$562.48	$129.65	$981.26	______
	269.37	767.54	476.28	______
	337.58	218.61	588.26	______
	125.45	841.26	218.15	______
	454.56	451.10	567.20	______
	______	______	______	______
20.	$84,128	$59,635	$79,328	______
	4650	84,687	95,567	______
	133	22,846	84,372	______
	67,284	78,209	76,819	______
	2538	70,764	98,427	______
	______	______	______	______

UNIT 4

Subtraction of Whole Numbers

Subtraction can be thought of as a form of addition. If 15 is to be subtracted from 20, the difference of 5 is usually obtained by adding 15 and 5 to make 20. In making change, the difference is almost always found by adding.

Subtraction is proved by adding the difference to the subtrahend.

Problems

Group 1

Subtract the following, using the addition method as much as possible:

1. 45	**2.** 19	**3.** 27	**4.** 82	**5.** 63	**6.** 70
36	13	17	75	59	45
7. 74	**8.** 29	**9.** 67	**10.** 24	**11.** 42	**12.** 40
48	15	42	16	37	21

13. $1.50	**14.** $2.00	**15.** $5.00	**16.** $10.00
1.35	1.87	3.65	8.20

Group 2

1. 980	**2.** 600	**3.** 1000	**4.** 739	**5.** 857
304	278	847	88	292
6. 718	**7.** 926	**8.** 1283	**9.** 14,327	**10.** 3584
672	879	897	7843	2796

11. $\begin{array}{r}27{,}268\\ \underline{19{,}789}\end{array}$ **12.** $\begin{array}{r}52{,}026\\ \underline{1937}\end{array}$ **13.** $\begin{array}{r}879{,}649\\ \underline{584{,}972}\end{array}$ **14.** $\begin{array}{r}936{,}785\\ \underline{386{,}946}\end{array}$

15. $\begin{array}{r}437{,}081\\ \underline{279{,}836}\end{array}$

Group 3

1. The Empire State Building is 1250 feet in height. The United Nations Building is 505 feet high. Of the two, how much higher is the Empire State Building?

2. During one month, Mr. Williams deposited $456.25 in his bank account and withdrew $275.62. How much remained in his account at the end of the month?

3. In one month the sales of a department store increased from $340,682 to $463,976. What was the amount of the increase?

4. A certain city decreased in population from 1,801,028 to 1,315,834. What was the decrease?

5. A builder sold a house for $14,250. The cost of building the house was $12,385. How much profit did the builder make?

6. Anthracite coal production increased in one year's time from 54,933,909 tons to 60,506,873 tons. What was the gain in production during that year?

7. In one year the number of business failures amounted to 9246. The lowest number of failures in a previous year was 809. Find the increase in failures between these two years.

8. The total individual income taxes collected for one year amounted to $17,153,307,947. During the preceding year, the taxes totaled $18,051,821,917. How much had the amount of taxes decreased?

9. Consumer installment credit for automobile sales increased in ten years from $227,000,000 to $3,790,000,000. What was the increase during the ten years?

10. 138,981,000 shares of stock were sold in one year. During the following year 459,717,623 shares of stock were sold. How many more shares of stock were sold in the second year?

UNIT 5

Subtraction Used in Business—Making Change

IN MAKING CHANGE, one uses the addition method of subtraction. When a $5 bill is given to a clerk in payment for a purchase amounting to $1.35, the clerk hands the customer a nickel, a dime, a half-dollar, and three $1 bills in succession, saying as he does so: "$1.35, $1.40, $1.50, $2.00, $3.00, $4.00, $5.00."

The important rule to be observed in making change is to use the smallest number of coins possible.

Problems

Group 1

Count orally the change required in the following problems:

	Amount of Sale	*Amount Received*		*Amount of Sale*	*Amount Received*
1.	$ .10	$ .50	**11.**	$1.15	$ 5.00
2.	.04	.25	**12.**	2.25	5.00
3.	.37	1.00	**13.**	1.46	5.00
4.	.16	1.00	**14.**	2.39	5.00
5.	.52	1.00	**15.**	3.76	5.00
6.	.12	.25	**16.**	2.84	10.00
7.	.18	.50	**17.**	8.42	10.00
8.	.45	1.00	**18.**	1.35	10.00
9.	.17	.50	**19.**	3.20	20.00
10.	.28	1.00	**20.**	5.60	20.00

CHANGE CHART

Group 2

Make a form like the following and complete the problems:

1.

			Coins					*Bills*			
No.	*Amount Received*	*Amount of Sale*	*.01*	*.05*	*.10*	*.25*	*.50*	*1.00*	*2.00*	*5.00*	*10.00*
1.	$ 5.00	$2.26	4		2		1	2			
2.	10.00	4.82									
3.	1.00	.67									
4.	1.00	.18									
5.	5.00	1.23									
6.	5.00	3.48									
7.	1.00	.15									
8.	1.00	.19									
9.	5.00	1.67									
10.	10.00	3.06									

Make forms like the following and complete the problems:

2.

No.	Amount Received	Amount of Sale	Coins					Bills			
			.01	*.05*	*.10*	*.25*	*.50*	*1.00*	*2.00*	*5.00*	*10.00*
1.	$ 1.00	$ .39									
2.	1.00	.07									
3.	5.00	2.29									
4.	10.00	3.47									
5.	20.00	6.32									
6.	10.00	7.84									
7.	5.00	1.16									
8.	5.00	2.58									
9.	1.00	.14									
10.	1.00	.21									

3.

No.	Amount Received	Amount of Sale	Coins					Bills			
			.01	*.05*	*.10*	*.25*	*.50*	*1.00*	*2.00*	*5.00*	*10.00*
1.	$10.00	$ .43									
2.	5.00	.18									
3.	20.00	2.26									
4.	10.00	4.32									
5.	1.00	.19									
6.	1.00	.31									
7.	1.00	.05									
8.	5.00	1.11									
9.	10.00	4.02									
10.	20.00	1.26									

GROUP 3

Extend all balances. Prove by subtracting total credits from total charges.

ACCOUNTS RECEIVABLE LEDGER

*Name*____

*Address*____

Date	*Invoice No.*	*Charges*	*Credits*	*Balance*
Feb. 1	137	106.50		106.50
3	186	235.60		
5	207	1432.80		
10			106.50	
12	320	532.40		
15			235.60	
18	347	862.95		
20	409	1162.83		
21			1395.35	
26	511	387.55		
28	618	565.40		

Extend and prove by adding all of the columns.

REPUBLIC MFG. CO.
CASH JOURNAL—RECEIPTS

October, ____

Date	*Amount Due*	*Discount*	*Cash Received*
Oct. 1	$ 467.28	$ 9.35	$457.93
3	78.65	2.26	
5	1432.90	28.66	
8	2427.30	169.42	
10	235.60	32.56	
11	786.40	58.34	
16	9322.00	465.00	
18	580.60	23.61	
21	1328.40	103.90	
25	168.92	2.84	
30	615.75	16.42	
Totals	$	$	$

Extend the balance for each day.

OLDS MFG. CO.
CHECK RECORD

		Check		
Date	*Deposit*	*No.*	*Amount*	*Balance*
Nov. 1				$435.15
1		201	118.26	
3		202	7.42	
3		203	85.60	
3		204	22.87	
7	206.75			
8		205	113.20	
8		206	74.90	
10		207	106.38	
10		208	45.72	
16	785.50	209	18.25	
16		210	261.34	
16		211	89.95	
21		212	76.42	
21		213	38.67	
21		214	55.40	
24	487.90			
26		215	162.45	
26		216	13.20	
30		217	140.20	
30		218	54.76	

Practice Test in Subtraction

1. 75	**2.** 47	**3.** 71	**4.** 98	**5.** 35
38	16	29	76	14
6. 93	**7.** 817	**8.** 709	**9.** 732	**10.** 914
46	350	687	60	39
11. 190	**12.** 161	**13.** 2390	**14.** 3250	**15.** 4756
84	48	842	1682	1837
16. 9430	**17.** $82.48	**18.** $12.72	**19.** $10.00	**20.** $32.73
6846	26.39	7.83	4.28	18.47

UNIT 6

Multiplication of Whole Numbers

MULTIPLICATION is the process of taking one number, called the *multiplicand,* as many times as there are units in another number, called the *multiplier.* The sign of multiplication is ×.

The number to be multiplied is the multiplicand; the number by which another number is multiplied is the multiplier; and the result of the multiplication is called the *product.* Thus, in $14 \times 11 = 154$, 14 is the multiplicand, 11 is the multiplier, and 154 is the product.

Multiplying by a Number of Three Digits

EXAMPLE. Multiply 374 by 286.

SOLUTION.

$$\begin{array}{r@{\qquad}l}
374 & \\
\underline{\times\ 286} & \\
2244 & (6 \times 374)\\
2992 & (80 \times 374)\\
\underline{748} & (200 \times 374)\\
106{,}964 & (286 \times 374)
\end{array}$$

Notice the positions of the first figure 4 in the first partial product, the first figure 2 in the second partial product, and the first figure 8 in the third partial product. State the rule for placing the digits in the partial products. What is the sum of the three partial products?

Methods of Checking Results in Multiplication

Interchanging multiplier and multiplicand. One of the most familiar methods of checking multiplication results is that of *interchanging multiplier and multiplicand,* as follows:

$$\begin{array}{r}
286\\
\underline{\times\ 374}\\
1144\\
2002\\
\underline{858}\\
106{,}964
\end{array}$$

Problems

Group 1

Multiply and prove the answer:

1. 47	**2.** 87	**3.** 528	**4.** 328
28	29	347	573
5. 2431	**6.** 5634	**7.** 694	**8.** 3524
322	4325	287	432
9. 64,827	**10.** 562	**11.** 398	**12.** 4326
423	432	562	3142
13. 8601	**14.** 7608	**15.** 26,492	**16.** 396,493
894	803	5873	37,428

Group 2

1. What is the total cost of 1250 shares of stock at $135.00 each?

2. An automobile agency sold 652 cars in one year at an average cost of $1742.00 each. What was the amount of the total sales?

3. The average yearly consumption per person of dressed meat in a certain year was 146 lbs. What would be average yearly consumption for a town of 2458 inhabitants?

4. In one year 75 houses were erected at an average cost of $17,500. What was the total cost of the houses?

5. A machine shop averaged 8326 engine parts a day. What was its total production for one week of five working days? For four weeks?

6. The per-pupil cost of textbooks and supplies in a certain high school for a year was $12.54. If the school had an enrollment of 1276 pupils, what was the total cost of the textbooks and supplies?

7. If a train made three round trips each week totaling 1850 miles per round trip, how far would the train travel in one year?

8. A factory employs 1562 men with an average monthly payroll of $406,120.00. What is the total average yearly payroll for the factory?

9. At one baseball game, 12,584 tickets were sold at $1.10 each and 6428 tickets were sold at $1.65 each. What were the total receipts for the day?

10. What is the total floor space in square feet of a factory building with five floors if the building measures 628 feet by 224 feet?

UNIT 7

Short Cuts in Multiplication

Multiplying by 10, 100, 1000, 40, 400, 4000, and so forth. To multiply an integer by 10, annex one zero; to multiply by 100, annex two zeros; to multiply by 1000, annex three zeros. To multiply an integer by 40, multiply by 4 and annex one zero; and so forth.

57 × 10 = 57 with one zero annexed = 570
69 × 1000 = 69 with three zeros annexed = 69,000
57 × 400 = 57 × 4 with two zeros annexed = 22,800

Problems

Group 1

Find the product in each of the following, using the above method:

1. 65 × 10 6[illegible]
2. 83 × 10
3. 145 × 10
4. 387 × 10
5. 106 × 10
6. 220 × 20 4[illegible]
7. 355 × 30
8. 1200 × 40 4[illegible]
9. 560 × 80
10. 1100 × 80
11. 26 × 100
12. 38 × 100
13. 165 × 100
14. 352 × 100
15. 290 × 100
16. 456 × 200
17. 150 × 400
18. 320 × 600
19. 125 × 800
20. 700 × 700
21. 37 × 1000
22. 98 × 1000
23. 150 × 1000
24. 175 × 1000
25. 386 × 1000
26. 110 × 2000
27. 250 × 4000
28. 180 × 5000
29. 320 × 6000
30. 240 × 8000

Multiplying numbers ending in zeros. To multiply numbers ending in zeros, multiply the numbers exclusive of the zeros and then annex to the product the total number of zeros on the ends of the original numbers.

240 × 120 = 24 × 12 with two zeros annexed = 28,800

Group 2

Find the products by the above method:

1. 60 × 70 4[illegible]
2. 20 × 40
3. 150 × 10
4. 30 × 80
5. 120 × 120 [illegible]
6. 620 × 20 12400
7. 280 × 30 7400
8. 25 × 50 1250
9. 330 × 20 6600
10. 250 × 60 15000
11. 590 × 20
12. 410 × 40
13. 1200 × 30
14. 1100 × 1100
15. 1500 × 1500

Multiplying by 9, 99, 999, and so forth. To multiply by 9, annex one zero to the number and subtract the number from the result; to multiply by 99, annex two zeros to the number and subtract the number from the result; and so forth.

$$256 \times 9 = 2560 - 256 = 2304$$
$$283 \times 99 = 28{,}300 - 283 = 28{,}017$$
$$265 \times 999 = 265{,}000 - 265 = 264{,}735$$

Group 3

Find the products by the above method:

1. 17 × 9
2. 24 × 9
3. 207 × 9
4. 390 × 9
5. 462 × 9
6. 63 × 99
7. 78 × 99
8. 651 × 99
9. 865 × 99
10. 207 × 99
11. 782 × 999
12. 109 × 999
13. 456 × 999
14. 738 × 999
15. 442 × 999

Multiplying by numbers slightly larger than 100 and slightly smaller than 100 (the complement method). To multiply by a number slightly larger than 100, annex two zeros to the multiplicand and add to the result the product of the multiplicand and the difference between the multiplier and 100. To multiply by a number slightly smaller than 100, annex two zeros to the multiplicand and subtract from the result the product of the multiplicand and the difference between 100 and the multiplier.

$$428 \times 107 = 42{,}800 + (428 \times 7) = 42{,}800 + 2996 = 45{,}796$$
$$352 \times 96 = 35{,}200 - (352 \times 4) = 35{,}200 - 1408 = 33{,}792$$

Group 4

Find the products by the above method:

1. 774 × 101
2. 268 × 99
3. 125 × 102
4. 216 × 98
5. 240 × 102
6. 500 × 105
7. 250 × 95
8. 192 × 97
9. 330 × 102
10. 700 × 104
11. 409 × 102
12. 299 × 99
13. 160 × 96
14. 614 × 104
15. 450 × 110

To multiply by 25, or by a multiple of 25; since 25 is $\frac{1}{4}$ of 100 first multiply the number by 100, then divide by 4.

EXAMPLE:

$$225 \times 25 =$$
$$225 \times 100 = 22{,}500$$
$$22{,}500 \div 4 = 5625$$

Since 50 is $\frac{1}{2}$ of 100, first multiply the number by 100, then divide by 2.

Example: $660 \times 50 =$
$660 \times 100 = 66{,}000$
$66{,}000 \div 2 = 33{,}000$

Since 75 is $\frac{3}{4}$ of 100, first multiply the number by 100, divide the product by 4, then multiply the result by 3.

Example: $248 \times 75 =$
$248 \times 100 = 24{,}800$
$24{,}800 \div 4 = 6200$
$6200 \times 3 = 18{,}600$

Since 250 is $\frac{1}{4}$ of 1000, first multiply the number by 1000, then divide by 4.

Example: $3842 \times 250 =$
$3842 \times 1000 = 3{,}842{,}000$
$3{,}842{,}000 \div 4 = 960{,}500$

Group 5

Find the products by one of the above methods:

1. 36 × 25
2. 124 × 25
3. 438 × 25
4. 394 × 50
5. 576 × 50
6. 872 × 50
7. 679 × 75
8. 827 × 75
9. 2435 × 25
10. 6897 × 50
11. 438 × 125
12. 1325 × 250
13. 4762 × 500
14. 8436 × 750
15. 2561 × 875

UNIT 8

Multiplication Used in Business

Stock Record

Extend and find total:

PERPETUAL STOCK RECORD

Furniture Department

From June 1, to Aug. 1, 19__ Stock Check

Article	*No.*	*On Hand*	*Rec.*	*Sold*	*On Hand*	*Price*	*Amt.*
D. Chairs...........	41	72	84	80	76	$ 4.20	$319.20
R. Chairs...........	124	8	12	13		9.40	
E. Chairs...........	317	6	8	11		11.90	
D. Tables...........	115	7	12	12		28.75	
L. Tables............	171	4	10	8		18.80	
G. L. Tables.........	148	5	9	9		15.50	
C. Tables...........	121	4	7	7		9.40	
T. Tables...........	311	5	10	8		23.20	
D. Beds.............	46	4	16	7		31.25	
D. Beds.............	58	6	7	7		41.25	
D. Beds.............	37	5	7	9		44.50	
V. Couches..........	119	4	7	7		51.75	
M. H. Couches.......	124	5	13	11		88.85	
L. Couches..........	188	6	7	8		92.50	
W. Beds.............	390	4	9	9		32.25	
B. Beds.............	412	6	10	10		28.75	
I. Beds..............	577	8	15	15		18.75	
I. Beds..............	588	9	15	10		16.50	
I. Beds..............	537	12	21	27		12.50	
Total...........							

Extend the amount and find total:

Inventory Sheet

Quantity	*Unit*	*Description*	*Unit Price*	*Amount*
60	feet	Stock #285	$1.25	$75.00
120	lb.	" #116	.65	
58	gal.	" #226	4.85	
24	doz.	" #125	1.85	
16	doz.	" #218	1.52	
75	qts.	" #167	1.16	
18	qts.	" #113	1.23	
25	feet	" #142	.89	

INVOICE

Make the extensions and find the total:

INVOICE

Our No. 1024
Your No. 468

PORTAGE SHOE COMPANY
Standard Building
St. Louis 5, Missouri

SOLD TO A. F. Edmonds Co.
1024 E. 86 St.
Dallas, Texas

DATE ______________ 19__

Terms Net—30 days

Shipped By Express

Quantity	*Description*	*Unit Price*	*Extension*
32 pr.	Ladies #628	10.24	$327.68
65 pr.	Ladies #386	7.55	
48 pr.	Ladies #514	12.18	
16 pr.	Ladies #220	8.78	
26 pr.	Ladies #115	6.32	
42 pr.	Ladies #118	9.44	
24 pr.	Ladies #132	6.75	
	Total		

Practice Test in Multiplication

Find the products of the following problems, using short cuts wherever possible.

1. 156 × 10
2. 437 × 20
3. 655 × 100
4. 253 × 300
5. 860 × 1000

6. 768 × 99
7. 450 × 102
8. 265 × 101
9. 800 × 50
10. 320 × 30

11. 106 × 99
12. 25 × 9
13. 270 × 999
14. 324 × 104
15. 182 × 98

16. 390 × 50
17. 6424 × 25
18. 432 × 75
19. 1030 × 250
20. 4368 × 500

21. 96
25
0

22. 280
67

23. 683
82

24. 845
325

25. 643
760
580

26. 9954
9803
62

27. 5356
524

28. 7618
681

29. An oil firm sold 27,528 gallons of gasoline in one day at a price of 26 cents a gallon. What were the total receipts?

30. If a city bus averaged 162 miles per day, how many miles would it travel in one year?

UNIT 9

Division of Whole Numbers

To DIVIDE a number ending in one or more zeros by 10, drop the last zero. To divide a number ending in two or more zeros by 100, drop the last two zeros. To divide a number ending in three or more zeros by 1000, drop the last three zeros.

$$86{,}000 \div 100 = 860$$

Divide, using the short method:

1. 520 ÷ 10
2. 5200 ÷ 100
3. 52,000 ÷ 1000
4. 40 ÷ 10
5. 6700 ÷ 100
6. 2400 ÷ 100
7. 5700 ÷ 10
8. 44,400 ÷ 100
9. 5720 ÷ 10
10. 68,000 ÷ 100
11. 15,000 ÷ 100
12. 844,000 ÷ 1000
13. 720 ÷ 10
14. 92,800 ÷ 100
15. 247,000 ÷ 100

To divide a number ending in zeros by a number ending in zeros, drop the number of zeros in the divisor from both numbers and divide the remaining part of the dividend by the remaining part of the divisor.

$$84{,}000 \div 4000 = 84 \div 4 = 21$$

Divide, using the short method:

1. 200 ÷ 20
2. 8000 ÷ 2000
3. 4500 ÷ 900
4. 6000 ÷ 20
5. 24,000 ÷ 200
6. 440 ÷ 20
7. 330 ÷ 10
8. 4800 ÷ 160
9. 270 ÷ 90
10. 64,000 ÷ 80
11. 5600 ÷ 80
12. 420 ÷ 70
13. 3600 ÷ 600
14. 12,000 ÷ 1200
15. 8880 ÷ 40

To divide a number ending in two or more zeros by 25, divide by 100 and then multiply by 4. To divide a number ending in two or more zeros by 50, divide by 100 and multiply by 2. To divide a number ending in three or more zeros by 125, divide by 1000 and multiply by 8.

$$8900 \div 25 = (8900 \div 100) \times 4 = 89 \times 4 = 356$$

Problems

Divide, using the short method:

1. 3600 ÷ 25
2. 7800 ÷ 50
3. 96,000 ÷ 75
4. 8000 ÷ 375
5. 6400 ÷ 25
6. 3800 ÷ 50
7. 15,000 ÷ 75
8. 48,000 ÷ 125
9. 4400 ÷ 25
10. 62,500 ÷ 25
11. 5600 ÷ 50
12. 7200 ÷ 75
13. 64,000 ÷ 875
14. 48,100 ÷ 25
15. 76,900 ÷ 50

Problems in Division

Group 1

Divide the following problems, using the short method:

1. 1640 ÷ 5
2. 2052 ÷ 3
3. 20,868 ÷ 6
4. 18,872 ÷ 8
5. 7412 ÷ 4
6. 19,650 ÷ 2
7. 34,216 ÷ 7
8. 11,205 ÷ 9
9. 21,135 ÷ 3
10. 45,115 ÷ 5
11. 28,360 ÷ 8
12. 23,046 ÷ 6
13. 64,939 ÷ 7
14. 17,348 ÷ 4
15. 22,833 ÷ 9

Group 2

Divide the following problems and prove your results:

1. 2472 ÷ 24
2. 8940 ÷ 56
3. 9648 ÷ 72
4. 17,500 ÷ 463
5. 65,720 ÷ 98
6. 9,726,240 ÷ 231
7. 12,844 ÷ 38
8. 15,928 ÷ 88
9. 74,688 ÷ 96
10. 73,040 ÷ 685
11. 159,488 ÷ 896
12. 186,204 ÷ 526
13. 468,225 ÷ 237
14. 462,794 ÷ 826
15. 255,501 ÷ 245

Group 3

1. The receipts from the sale of lots in a real estate development were $255,500. If the average price of the lots was $1750, how many lots were sold?

2. If a man borrows $1215, to be repaid at $67.50 a month, how many months will it take him to repay the loan?

3. A man sold his farm containing 120 acres for $19,800. How much did he receive per acre?

4. In one term of school, a library issued 35,216 volumes. If the number of pupils in the school was 568, what was the average number of books issued to each pupil?

5. A salesman received $4740 during a year in which he worked 48 weeks. What was his average weekly commission?

6. A salesman's commissions for six consecutive months were as follows: $352.60, $287.25, $460.40, $295.85, $310.70, and $318.65. What was his average monthly income?

7. A man drives an automobile for seven days the following number of miles daily: 374, 476, 285, 343, 380, 418, and 397. What is the average distance driven per day?

8. On five successive days a machinist made the following number of parts during the day: 5286, 4762, 3867, 4532, and 4728. What was the average number of parts made daily for the five days?

9. The weights of a football team were as follows: 186 lb., 175 lb., 212 lb., 165 lb., 182 lb., 225 lb., 206 lb., 155 lb., 194 lb., 181 lb., 209 lb. What was the average weight?

10. In one class 2 pupils received marks of 96; 4 received 90; 6 received 85; 5 received 80; 3 received 75; 4 received 70; 3 received 60; 3 received 50. What was the average grade for the class?

Practice Test in Division

Divide, using short cuts wherever possible and proving as many as time permits.

1. 460 ÷ 10
2. 8200 ÷ 100
3. 45,000 ÷ 1000
4. 3600 ÷ 100
5. 55,400 ÷ 10
6. 560 ÷ 80
7. 6600 ÷ 300
8. 2200 ÷ 110
9. 25,000 ÷ 250
10. 8880 ÷ 20
11. 4200 ÷ 25
12. 24,000 ÷ 75
13. 38,000 ÷ 50
14. 32,000 ÷ 375
15. 65,000 ÷ 125
16. 2596 ÷ 4
17. 2856 ÷ 6
18. 9822 ÷ 3
19. 36,624 ÷ 8
20. 40,061 ÷ 7
21. 2575 ÷ 46
22. 33,132 ÷ 35
23. 25,284 ÷ 68
24. 18,874 ÷ 32
25. 74,592 ÷ 95
26. 592,504 ÷ 474
27. 256,327 ÷ 652
28. 176,228 ÷ 533
29. 246,672 ÷ 671
30. 864,360 ÷ 609

UNIT 10

Factoring

THOSE numbers which, when multiplied together, produce a certain number are the *factors* of that number. Thus, 4 and 7 are factors of 28. What are the factors of 9? 12? 18? 32? 48?

A number not exactly divisible by any number except itself and 1 is a *prime number.* Thus, 7 is a prime number.

Prime numbers are *prime factors.*

A number composed of two or more integral factors other than itself and 1 is a *composite number.* Thus, 21 is a composite number (3 × 7 = 21).

Now, 6 and 4 are factors of 24, but they are not its prime factors. The prime factors are 2, 2, 2, and 3. By the *factors* of a number we usually mean its *prime factors.*

Test of Divisibility of Numbers

All even numbers are divisible by 2. A number is even if its unit number is 2, 4, 6, 8, or 0.

A number is divisible by 3 if the sum of its digits is divisible by 3.

Thus, 528 is divisible by 3 because $5 + 2 + 8 = 15$, which is divisible by 3.

A number is divisible by 4 if its last two digits are ciphers or express a number divisible by 4. Thus, 1864 is divisible by 4 because 64 is divisible by 4.

A number is divisible by 5 if its unit figure is 5 or 0. Thus, 5, 25, 30, 45, and 60 are divisible by 5.

An even number is divisible by 6 if the sum of its digits is divisible by 3. Thus, 216, 396, and 6732 are divisible by 6.

There is no simple method of testing the divisibility of a number by 7.

A number is divisible by 8 if its last three digits are ciphers or express a number divisible by 8. Thus, 18,256 is divisible by 8 because 256 is divisible by 8.

A number is divisible by 9 if the sum of its digits is divisible by 9. Thus, 7659 is divisible by 9 because $7 + 6 + 5 + 9 = 27$ which is divisible by 9.

A number is divisible by 10 if it ends in zero.

A number is divisible by 11 if the sum of the digits in the even places equals the sum of the digits in the odd places, counting from the right, or if the difference between these two sums is 11 or some multiple of 11. Thus, 182,831 is divisible by 11 because $1 + 8 + 8 = 17$, $3 + 2 + 1 = 6$, and $17 - 6 = 11$.

A number is divisible by 25 if its last two digits are ciphers or express a number divisible by 25. Thus, 3875 is divisible by 25 because 75 is divisible by 25.

Finding the Prime Factors of a Number

The example below indicates the method of finding the prime factors of a number. As we can see from this example, the prime factors of 8652 are 2, 2, 3, 7, and 103. The large factors are 84 and 103. Unless one has access to factor tables, the only method of determining large factors is by trying the prime numbers until the right one is found.

$$\begin{array}{r@{\,}r} 2) & \underline{8652} \\ 2) & \underline{4326} \\ 3) & \underline{2163} \\ 7) & \underline{721} \\ & 103 \end{array}$$

Multiplying by the Factor Method

Multiplying successively by the factors of the multiplier gives the same result as multiplying once by the whole multiplier, as shown in the example below. Since 7 and 8 are factors of 56, multiplying 346 by 7 and then this result by 8 gives the same result as multiplying 346 by 56.

$$\begin{array}{rr}
346 & 346 \\
\underline{56} & \underline{7} \\
2076 & 2422 \\
\underline{1730} & \underline{8} \\
19{,}376 & 19{,}376
\end{array}$$

Dividing by the Factor Method

The factors of the divisor can be substituted for the original divisor in division. The following example shows that dividing 2016 by 4 and then this result by 7 gives the same result as dividing 2016 by 28.

$$\begin{array}{rr}
72 & \\
28\overline{)2016} & 4\underline{)2016} \\
\underline{196} & 7\underline{)504} \\
56 & 72 \\
\underline{56} &
\end{array}$$

When the factor method can be used, it helps to prove problems in division and multiplication.

Problems

Group 1

Find the product of each of the following pairs of factors:

1. 17 and 6 **2.** 35 and 4 **3.** 18 and 7

4. If 5 is one factor of 120, what is the other?
5. If 8 is one factor of 128, what is the other?
6. Name the prime numbers between 1 and 100.

Find the prime factors of the following numbers:

7. 38 **8.** 84 **9.** 96 **10.** 140 **11.** 200

12. How can you tell that 1056 is divisible by 3?
13. How can you tell that 856 is not divisible by 6?
14. How can you tell that 8964 is not divisible by 11?
15. How can you tell that 8964 is divisible by 9?
16. Give a number of 5 digits that is divisible by 9.

Determine which of the following numbers are divisible by 4, by 5, by 8, by 11, and by 25:

17. 2816
18. 2784
19. 1275
20. 6567
21. 2700
22. 12,700
23. 1270
24. 11,850

25. Show how speed in factoring is dependent upon a knowledge of the tests of divisibility of numbers.

GROUP 2

Find the prime factors of the following numbers:

1. 56
2. 64
3. 144
4. 168
5. 976
6. 1125
7. 6448
8. 3848
9. 10,675
10. 8050
11. 12,625
12. 15,626

Divide, proving results by the factor method:

13. 4116 ÷ 49
14. 5536 ÷ 32
15. 8064 ÷ 72
16. 2072 ÷ 56
17. 5568 ÷ 96
18. 10,854 ÷ 81

Multiply, proving results by the factor method:

19. 491 × 63
20. 537 × 45
21. 48 × 762
22. 72 × 324
23. 849 × 24
24. 472 × 49

25. (*a*) Solve the following the long way and then the short way. (*b*) What principle do you use to shorten the work?

$$\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6}$$

UNIT 11

Greatest Common Divisor and Least Common Multiple

Finding the Greatest Common Divisor

A NUMBER that will exactly divide each of two or more numbers is called a *common divisor* of the numbers. Thus, 3 is a common divisor of 9, 12, and 15.

In reducing common fractions to their lowest terms, it is necessary to find the greatest common divisor.

To find the greatest common divisor of two or more numbers, first find the prime factors of each number. The product of all the prime factors is the *greatest common divisor.* It is apparent in the example below that 2, 2, and 3 are common to 36, 72, and 84. Therefore, the greatest common divisor of the three numbers is the product of 2 × 2 × 3, or 12.

$$\begin{array}[t]{r} 2\underline{)36} \\ 2\underline{)18} \\ 3\underline{)\ 9} \\ 3 \end{array} \qquad\qquad \begin{array}[t]{r} 2\underline{)72} \\ 2\underline{)36} \\ 2\underline{)18} \\ 3\underline{)\ 9} \\ 3 \end{array} \qquad\qquad \begin{array}[t]{r} 2\underline{)84} \\ 2\underline{)42} \\ 3\underline{)21} \\ 7 \end{array}$$

$$2 \times 2 \times 3 = 12$$

Another method of finding the greatest common divisor is to divide each of the numbers by some number that will exactly divide each of them. Continue the process until no number can be found that will divide each of the new quotients. Multiply together all the divisors. In the example below, the product 12 is the greatest common divisor.

$$\begin{array}{rrrr} 2) & 36 & 72 & 84 \\ \cline{2-4} 2) & 18 & 36 & 42 \\ \cline{2-4} 3) & 9 & 18 & 21 \\ \cline{2-4} & 3 & 6 & 7 \end{array}$$

$$2 \times 2 \times 3 = 12$$

The greatest common divisor can also be found as follows: Divide the smallest number into the other numbers, and bring down to the next line the divisor and the remainders of the divisions. Continue this process until there are no more remainders. The last divisor is the greatest common divisor.

$$\begin{array}{rrr} 36 & 72 & 84 \\ \hline 36 & 0 & 12 \\ \hline 0 & 0 & 12 \end{array}$$

Finding the Least Common Multiple

A *common multiple* of two or more numbers is any number that will contain the given numbers without remainders. Thus, 18 is a common multiple of 6 and 9 because it contains 6 and 9, each without a remainder.

The *least common multiple* of two or more numbers is the smallest number that will contain each of the numbers without remainders. Thus, 36 is the least common multiple of 6, 9, and 12 because it is the smallest number that will contain these numbers without a remainder. This answer is obtained by trying 12, the largest number, then 24 (12 × 2), and finally 36 (12 × 3). Notice that in this problem the lowest common multiple is a multiple of the largest number in the series.

In most cases the least common multiple can be found by inspection. Thus, in the case of 16, 24, and 48 it is apparent that 48, the largest number in the series, is the least common multiple. The rule to remember is that the lowest common denominator of two or more numbers cannot be smaller than the largest number of the group.

When the least common multiple cannot be found readily by inspection, the following is a good method to use: Divide the numbers by a common factor. Divide the quotients by a common factor, and continue the process until no further divisions can be made. Then multiply together all the divisors and the remaining quotients; the product will be the least common multiple. Thus, in the example below, 2 × 2 × 3 × 2 × 2 × 7 × 2 = 672, which is the least common multiple of 12, 48, 84, and 96.

$$\begin{array}{r|rrrr}
2 & 12 & 48 & 84 & 96 \\ \hline
2 & 6 & 24 & 42 & 48 \\ \hline
3 & 3 & 12 & 21 & 24 \\ \hline
2 & 1 & 4 & 7 & 8 \\ \hline
2 & 1 & 2 & 7 & 4 \\ \hline
 & 1 & 1 & 7 & 2
\end{array}$$

$$2 \times 2 \times 3 \times 2 \times 2 \times 7 \times 2 = 672$$

Problems

Group 1

Give two common multiples of each of the following groups of numbers:

1. 3, 4, 8 **2.** 10, 15, 20 **3.** 2, 3, 7 **4.** 3, 5, 8

Find by inspection the least common multiple of each of the following groups of numbers:

5. 4, 8, 12, 24 **6.** 6, 12, 18 **7.** 3, 6, 9, 21

Group 2

Find the greatest common divisor of each of the following groups of numbers:

1. 72, 88, 96
2. 68, 112, 240
3. 95, 125, 245
4. 48, 84, 96, 124
5. 112, 228, 268, 320
6. 21, 84, 126, 147

Find the least common multiple of each of the following groups of numbers:

7. 3, 9, 18, 27
8. 6, 15, 36, 42
9. 5, 15, 25, 35
10. 36, 48, 72, 96
11. 24, 72, 120, 128
12. 9, 27, 39, 78

Chapter Test—Review

ADDITION

1. 12	**2.** 40	**3.** 678	**4.** 568	**5.** 321
84	91	904	437	789
37	85	581	385	346
63	76	490	595	674
45	33	782	672	530

6. 321	**7.** 648	**8.** 3216	**9.** 7284	**10.** 3216
257	212	6256	6795	7144
192	698	8432	9795	6756
608	385	7146	2654	6849
678	527	8755	1657	1287

SUBTRACTION

11. 322	**12.** 908	**13.** 722	**14.** 6000	**15.** 5072
148	69	625	2542	3848

16. 87,694	**17.** 66,540	**18.** 72,674	**19.** 28,452	**20.** 450,000
8268	32,855	28,795	7648	5652

MULTIPLICATION

21. 85	**22.** 678	**23.** 542	**24.** 837	**25.** 608
5	8	64	76	80

26. 576	**27.** 956	**28.** 7854	**29.** 8016	**30.** 6070
674	503	780	368	508

DIVISION

31. $5\overline{)240}$
32. $6\overline{)756}$
33. $4\overline{)1556}$
34. $7\overline{)4788}$
35. $30\overline{)21,840}$
36. $58\overline{)26,796}$
37. $46\overline{)25,484}$
38. $40\overline{)34,000}$
39. $57\overline{)15,276}$
40. $462\overline{)267,036}$

Find the prime factors of the following numbers:

41. 48
42. 128
43. 2832
44. 4550
45. 4212
46. 2448
47. 8462
48. 5764

Find the greatest common divisor of each of the following groups of numbers:

49. 12, 24, 36, 48

50. 75, 145, 225

51. 24, 72, 84, 108

52. 27, 54, 66, 75

Find the least common multiple of each of the following groups of numbers:

53. 5, 10, 25, 40

54. 4, 8, 16, 32

55. 18, 54, 96, 124

56. 22, 38, 66, 122

Chapter 3

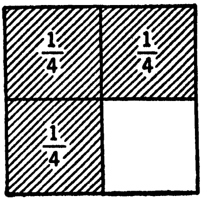
Common Fractions

UNIT 1

Reduction of Common Fractions

Meaning of Terms

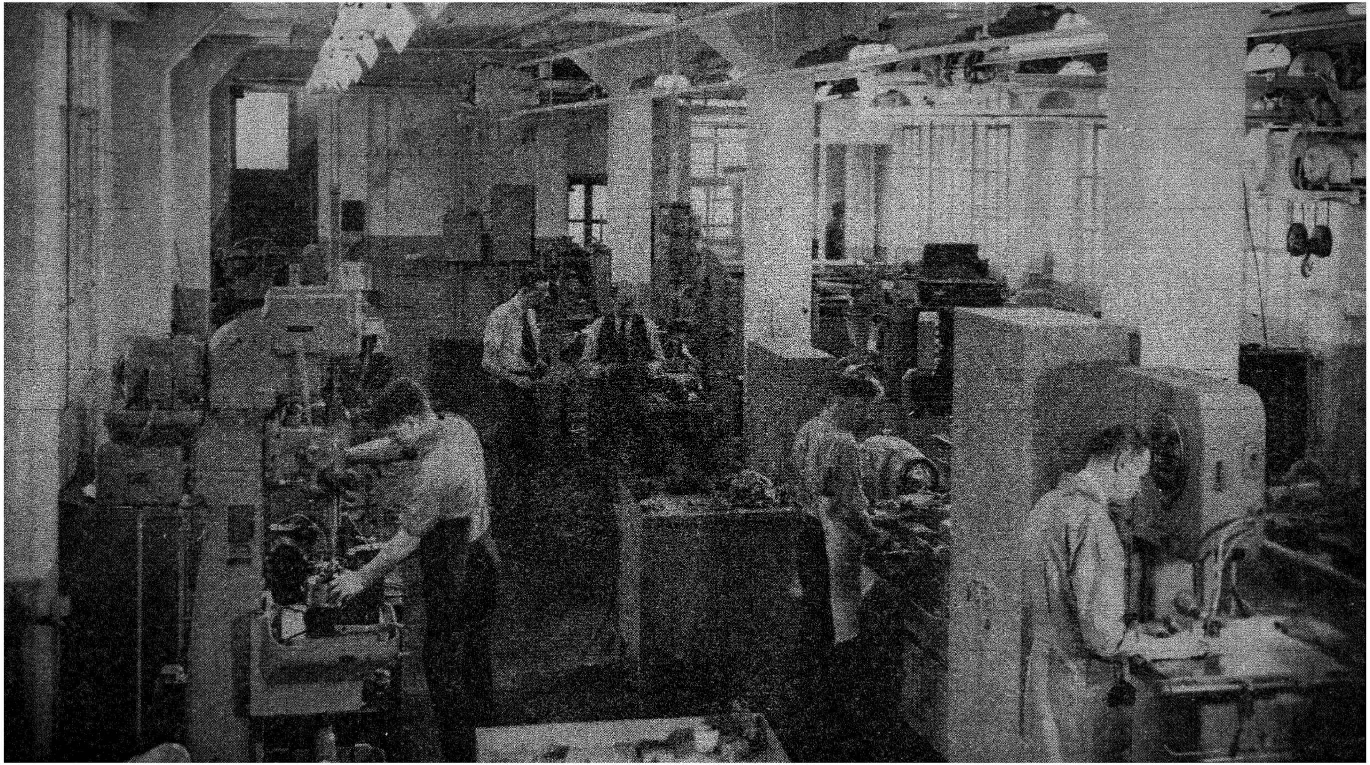
Try the following demonstration: Fold a piece of paper from the bottom edge to the top edge and then from the right edge to the left edge. Open it. You will see that the creases divide the paper into sections. Each section is what fractional part of the paper? Three sections are what fractional part of the paper?



This piece of paper represents a unit, and this unit is divided into four equal parts. One of the equal parts is $\frac{1}{4}$ of the unit; the other three parts are $\frac{3}{4}$ of the unit. Hence, a *fraction* may be one or more equal parts of a unit.

The lower term of the fraction shows into how many equal parts the whole number has been divided. It is the name of the fractional unit and is called the *denominator.* The upper part shows the number of fractional units in the fraction. It is called the *numerator. Common fractions* are classified as simple, compound, and complex, proper and improper, and as parts of mixed numbers.

A *simple fraction* is one whose numerator and denominator are whole numbers. Thus, $\frac{3}{4}$ is a simple fraction. A *compound fraction* is a fraction of a fraction. Thus $\frac{3}{4}$ of $\frac{5}{12}$ is a compound fraction. A *complex fraction* is a fraction in which either or both the numerator and the denominator are not whole numbers. Thus, $\frac{5\frac{1}{2}}{12}$, $\frac{6}{7\frac{1}{2}}$, and $\frac{3\frac{3}{4}}{5\frac{2}{3}}$ are complex fractions. A *proper fraction* is one in which the numerator is less than the denominator. Thus, $\frac{3}{4}$ is a proper fraction. An *improper fraction* is one in which the numera-



A Testing Laboratory. Calculations play an important part in industry, especially in a testing laboratory of a factory.

tor equals or exceeds the denominator. Thus, $\frac{12}{12}$ and $\frac{16}{12}$ are improper fractions. A *mixed number* is a whole number and a fraction taken together. Thus $10\frac{1}{2}$ is a mixed number.

Changing Improper Fractions to Whole Numbers or Mixed Numbers

EXAMPLE: Express the length of a piece of lumber that is 44 in. long in feet and a fraction of a foot.

In the language of arithmetic, the problem is to change the improper fraction $\frac{44}{12}$ to a mixed number.

SOLUTION. $\frac{44}{12} = 44 \div 12 = 3\frac{8}{12}$, number of feet in 44 in.

Hence, $\frac{44}{12}$, the improper fraction, equals $3\frac{8}{12}$, the mixed number.

To change an improper fraction to a whole number or a mixed number, divide the numerator by the denominator.

Problems

Change the following to whole or mixed numbers:

1. $\frac{24}{6}$
2. $\frac{12}{3}$
3. $\frac{9}{4}$
4. $\frac{25}{6}$
5. $\frac{11}{8}$
6. $\frac{8}{3}$
7. $\frac{18}{7}$
8. $\frac{6}{5}$
9. $\frac{4}{3}$
10. $\frac{7}{2}$
11. $\frac{9}{6}$
12. $\frac{10}{4}$
13. $\frac{48}{8}$
14. $\frac{12}{7}$
15. $\frac{34}{14}$
16. $\frac{18}{4}$
17. $\frac{14}{5}$
18. $\frac{8}{5}$
19. $\frac{32}{9}$
20. $\frac{35}{11}$
21. $\frac{18}{3}$
22. $\frac{64}{12}$
23. $\frac{40}{14}$
24. $\frac{15}{10}$
25. $\frac{7}{4}$

Changing Mixed Numbers to Improper Fractions

EXAMPLE: Change $10\frac{1}{2}$ to an improper fraction.

SOLUTION.

$$10 \times 2 = 20$$
$$20 + 1 = 21$$
$$\text{Hence, } 10\tfrac{1}{2} = \tfrac{21}{2}$$

To change a mixed number to an improper fraction, multiply the whole number by the denominator, add the numerator to the product, and place the result over the denominator.

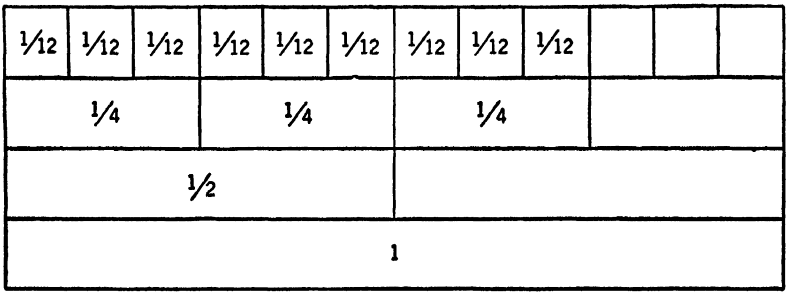
Problems

Change the following to improper fractions:

1. $6\frac{1}{2}$
2. $8\frac{4}{5}$
3. $5\frac{2}{9}$
4. $7\frac{2}{3}$
5. $3\frac{5}{12}$
6. $5\frac{2}{5}$
7. $12\frac{1}{4}$
8. $6\frac{2}{7}$
9. $16\frac{1}{3}$
10. $4\frac{1}{4}$
11. $6\frac{7}{10}$
12. $4\frac{4}{9}$
13. $5\frac{4}{13}$
14. $7\frac{3}{7}$
15. $8\frac{2}{3}$
16. $2\frac{4}{7}$
17. $16\frac{1}{12}$
18. $15\frac{5}{14}$
19. $42\frac{4}{11}$
20. $71\frac{1}{2}$
21. $109\frac{9}{11}$
22. $25\frac{2}{3}$
23. $96\frac{12}{13}$
24. $57\frac{2}{16}$
25. $84\frac{3}{24}$

Reducing Fractions to Lowest Terms and to Higher Terms

EXAMPLE: (*a*) Reduce 9 in. to a part of a foot; that is, reduce $\frac{9}{12}$ to lowest terms. (*b*) Reduce $\frac{1}{2}$ ft. to inches; that is, reduce $\frac{1}{2}$ to twelfths.



SOLUTION. (*a*) $\frac{9}{12} = \frac{9}{12} \div \frac{3}{3} = \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$

(*b*) $\frac{1}{2} = \frac{1}{2} \times \frac{2}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$

$\frac{2}{4} = \frac{2}{4} \times \frac{3}{3} = \frac{2 \times 3}{4 \times 3} = \frac{6}{12}$

Therefore, we can say that multiplying or dividing both numerator and denominator by the same number does not change the value of a fraction.

To reduce a fraction to its lowest terms, divide both its numerator and its denominator by any common divisor and continue to divide until no common divisor greater than one can be found.

To change a fraction to higher terms, multiply both numerator and denominator by the same number.

Problems

GROUP 1

Reduce the following to lowest terms:

1. $\frac{25}{50}$
2. $\frac{4}{12}$
3. $\frac{21}{36}$
4. $\frac{25}{80}$
5. $\frac{9}{300}$
6. $\frac{24}{90}$
7. $\frac{49}{56}$
8. $\frac{12}{80}$
9. $\frac{12}{54}$
10. $\frac{49}{63}$
11. $\frac{45}{54}$
12. $\frac{15}{70}$
13. $\frac{64}{88}$
14. $\frac{33}{77}$
15. $\frac{14}{35}$
16. $\frac{27}{36}$
17. $\frac{14}{200}$
18. $\frac{105}{125}$
19. $\frac{36}{96}$
20. $\frac{7}{42}$
21. $\frac{81}{126}$
22. $\frac{24}{104}$
23. $\frac{18}{66}$
24. $\frac{72}{168}$
25. $\frac{84}{210}$

GROUP 2

Change the following to higher terms:

1. $\frac{1}{3} = \frac{2}{9}$
2. $\frac{3}{4} = \frac{15}{20}$
3. $\frac{5}{6} = \frac{15}{18}$
4. $\frac{1}{2} = \frac{\quad}{48}$
5. $\frac{5}{12} = \frac{\quad}{144}$
6. $\frac{4}{9} = \frac{\quad}{72}$
7. $\frac{5}{11} = \frac{\quad}{66}$
8. $\frac{4}{7} = \frac{\quad}{56}$
9. $\frac{7}{24} = \frac{\quad}{96}$
10. $\frac{5}{16} = \frac{\quad}{80}$
11. $\frac{3}{20} = \frac{\quad}{100}$
12. $\frac{2}{3} = \frac{\quad}{48}$
13. $\frac{4}{15} = \frac{\quad}{105}$
14. $\frac{3}{5} = \frac{\quad}{85}$
15. $\frac{15}{16} = \frac{\quad}{80}$
16. $\frac{5}{6} = \frac{\quad}{72}$
17. $\frac{3}{7} = \frac{\quad}{56}$
18. $\frac{5}{8} = \frac{\quad}{176}$
19. $\frac{4}{11} = \frac{\quad}{121}$
20. $\frac{7}{12} = \frac{\quad}{120}$
21. $\frac{7}{9} = \frac{\quad}{108}$
22. $\frac{11}{12} = \frac{\quad}{84}$
23. $\frac{14}{35} = \frac{\quad}{140}$
24. $\frac{11}{24} = \frac{\quad}{144}$
25. $\frac{7}{35} = \frac{\quad}{140}$

UNIT 2

Addition of Common Fractions and Mixed Numbers

Adding Fractions Having the Same Denominator

EXAMPLE 1. How much lumber is required for the two sides of the bookcase if each one measures 44 in., or $3\frac{8}{12}$ ft.?

SOLUTION.

$$\begin{array}{l} 3\frac{8}{12} \\ \underline{3\frac{8}{12}} \\ 6\frac{16}{12} = 7\frac{4}{12}, \text{ or } 7\frac{1}{3}, \text{ number of feet of lumber needed for the two sides.} \end{array}$$

Fractions having the same denominator are added by adding the numerators. Thus, $\frac{8}{12} + \frac{8}{12} = \frac{16}{12}$. By changing the improper fraction $\frac{16}{12}$ to a mixed number, we obtain $1\frac{4}{12}$. The sum of the whole numbers is 6, and $6 + 1\frac{4}{12} = 7\frac{4}{12}$.

Adding Fractions Having Different Denominators

EXAMPLE 2. Add $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{5}{6}$.

SOLUTION. $$\frac{8 + 9 + 10}{12} = \frac{27}{12} = 2\frac{1}{4}$$

When fractions with different denominators are added, the result is a fraction with the least common multiple of the denominators as the denominator and the sum of the numerators expressed in terms of the new denominator as the numerator. The least common denominator of the denominators 3, 4, and 6 is 12. By expressing each fraction in terms of the least common denominator, we obtain $\frac{8}{12} + \frac{9}{12} + \frac{10}{12}$. By adding the numerators and placing the total over the common denominator, we obtain $\frac{27}{12}$, or $2\frac{1}{4}$.

Finding the Sum of Mixed Numbers

EXAMPLE 3. Add $7\frac{1}{2}$, $14\frac{3}{4}$, $8\frac{2}{3}$, and $23\frac{5}{6}$.

SOLUTION.

$$\begin{aligned} 7\tfrac{1}{2} &= 7\tfrac{6}{12} \\ 14\tfrac{3}{4} &= 14\tfrac{9}{12} \\ 8\tfrac{2}{3} &= 8\tfrac{8}{12} \\ 23\tfrac{5}{6} &= \underline{23\tfrac{10}{12}} \\ & 52\tfrac{33}{12}, \text{ or } 52 + 2\tfrac{9}{12}, \text{ or } 54\tfrac{3}{4} \end{aligned}$$

To find the sum of mixed numbers, add the fractions first and then add their sum to the sum of the whole numbers. In Example 3 the fractions are rewritten with the common denominator 12. The sum of the fractions, $\frac{33}{12}$, or $2\frac{9}{12}$, plus the sum of the whole numbers, 52, is $54\frac{3}{4}$.

Short Method of Adding Two Fractions Whose Numerators Are 1

EXAMPLE 4. (*a*) Add $\frac{1}{2}$ and $\frac{1}{3}$. (*b*) Add $\frac{1}{4}$ and $\frac{1}{3}$.

SOLUTION. (*a*) $\frac{1}{2} + \frac{1}{3} = \dfrac{2+3}{2 \times 3} = \frac{5}{6}$ (*b*) $\frac{1}{4} + \frac{1}{3} = \dfrac{4+3}{4 \times 3} = \frac{7}{12}$

The sum of two fractions whose numerators are 1 is the sum of their denominators over the product of their denominators.

Problems

GROUP 1

Add, using the short method whenever possible, and reduce answers to lowest terms:

1. $\frac{2}{4} + \frac{3}{4}$
2. $\frac{1}{4} + \frac{1}{8}$
3. $\frac{1}{2} + \frac{1}{4}$
4. $\frac{1}{5} + \frac{1}{2}$
5. $\frac{1}{2} + \frac{3}{4}$
6. $\frac{3}{4} + \frac{7}{8} + \frac{1}{2}$
7. $\frac{5}{8} + \frac{3}{4} + \frac{7}{8} + \frac{1}{2}$
8. $\frac{2}{3} + \frac{1}{2} + \frac{5}{6} + \frac{1}{3}$
9. $4\frac{1}{2} + 9\frac{3}{4}$
10. $16\frac{1}{2} + 8\frac{2}{3}$
11. $3\frac{1}{2} + 7\frac{3}{4} + 5\frac{5}{8}$
12. $4\frac{1}{3} + 8\frac{1}{2} + 3\frac{5}{6}$

GROUP 2

Add and reduce answers to lowest terms:

1. $\frac{1}{6} + \frac{1}{3} + \frac{1}{12}$
2. $5\frac{1}{2} + 3\frac{1}{3}$
3. $3\frac{1}{3} + 5\frac{3}{4} + 6\frac{5}{12}$
4. $2\frac{1}{2} + \frac{1}{4} + \frac{5}{12} + 8\frac{1}{6}$
5. $12\frac{1}{3} + 15\frac{1}{2} + 9\frac{5}{6} + 13\frac{3}{4}$
6. $7\frac{3}{5} + \frac{7}{10} + 15\frac{1}{2} + 9\frac{3}{4}$
7. $17\frac{2}{3} + 5\frac{3}{4} + 21\frac{2}{3} + 18\frac{3}{4}$
8. $16\frac{5}{8} + 12\frac{5}{6} + 31\frac{1}{3} + 29\frac{7}{12}$

Add upward and across:

9.
$$\begin{array}{l} \frac{1}{2} + \frac{1}{3} + \frac{1}{4} \\ \frac{5}{6} + \frac{3}{4} + \frac{1}{3} \\ \frac{2}{3} + \frac{5}{6} + \frac{1}{2} \\ \hline \end{array}$$

10.
$$\begin{array}{l} \frac{2}{3} + \frac{3}{8} + \frac{1}{6} \\ \frac{1}{2} + \frac{5}{6} + \frac{1}{4} \\ \frac{3}{4} + \frac{1}{3} + \frac{5}{8} \\ \hline \end{array}$$

Add:

11.
$$\begin{array}{r} 245\frac{3}{8} \\ 17\frac{3}{4} \\ 418\phantom{\frac{1}{2}} \\ 359\frac{1}{2} \\ 9\frac{2}{3} \\ 18\frac{5}{12} \\ \hline \end{array}$$

12.
$$\begin{array}{r} 15\frac{1}{4} \\ 128\frac{2}{3} \\ 117\frac{5}{6} \\ 135\frac{1}{2} \\ 19\frac{7}{8} \\ 726\frac{3}{4} \\ \hline \end{array}$$

13.
$$\begin{array}{r} 657\frac{1}{4} \\ 19\frac{1}{6} \\ 332\frac{3}{8} \\ 19\frac{1}{2} \\ 225\frac{2}{3} \\ 546\frac{5}{6} \\ 37\frac{1}{2} \\ 462\frac{3}{4} \\ \hline \end{array}$$

UNIT 3

Subtraction of Common Fractions and Mixed Numbers

Subtracting Fractions with Like Denominators

EXAMPLE 1. If $7\frac{4}{12}$ ft., the length required for the two sides of a bookcase, are cut from a board $10\frac{6}{12}$ ft. long, how many feet are left?

SOLUTION.
$$\begin{array}{l} 10\frac{6}{12}\text{ ft.} \\ \underline{-7\frac{4}{12}\text{ ft.}} \\ 3\frac{2}{12}\text{ ft., or } 3\frac{1}{6}\text{ ft., length of piece remaining.} \end{array}$$

The difference between two mixed numbers is found by first subtracting the fractions and then subtracting the whole numbers. When both fractions have the same denominator, their difference is obtained by subtracting the numerators and placing the difference over the denominator.

EXAMPLE 2. If $7\frac{4}{12}$ ft. are cut from a board $10\frac{3}{12}$ ft. long, how many feet are left?

SOLUTION. $10\frac{3}{12}\text{ ft.} = 9\frac{12}{12}\text{ ft.} + \frac{3}{12}\text{ ft.} = 9\frac{15}{12}\text{ ft.}$
$$\begin{array}{l} 9\frac{15}{12}\text{ ft.} \\ \underline{-7\frac{4}{12}\text{ ft.}} \\ 2\frac{11}{12}\text{ ft., length of piece remaining.} \end{array}$$

When the fraction in the minuend is smaller than the fraction in the subtrahend, borrow 1 unit from the whole number in the minuend and add it in the form of a fraction to the original fraction in the minuend. Then subtract the resulting fractions and whole numbers.

Subtracting Fractions with Unlike Denominators

EXAMPLE 3. From $\frac{2}{3}$ take $\frac{3}{5}$.

SOLUTION. $\frac{2}{3} - \frac{3}{5} = \frac{10}{15} - \frac{9}{15} = \frac{1}{15}$

To subtract fractions with unlike denominators, change them to fractions with like denominators and find the difference between the numerators. Place the result over the common denominator. Reduce the final fraction to its lowest terms if necessary.

Short Method of Subtracting Two Fractions Whose Numerators Are 1

EXAMPLE 4. (*a*) From $\frac{1}{2}$ take $\frac{1}{3}$. (*b*) From $\frac{1}{3}$ take $\frac{1}{4}$.

SOLUTION. (*a*) $\frac{1}{2} - \frac{1}{3} = \frac{3-2}{3 \times 2} = \frac{1}{6}$ (*b*) $\frac{1}{3} - \frac{1}{4} = \frac{4-3}{4 \times 3} = \frac{1}{12}$

The difference between two fractions whose numerators are 1 is the difference between the denominators over the product of the denominators.

Problems

GROUP 1

Subtract, using the short method whenever possible:

1. $\frac{3}{4} - \frac{1}{4}$
2. $\frac{1}{2} - \frac{1}{5}$
3. $\frac{1}{2} - \frac{1}{4}$
4. $\frac{2}{3} - \frac{1}{2}$
5. $\frac{3}{5} - \frac{1}{2}$
6. $\frac{3}{4} - \frac{3}{8}$
7. $\frac{5}{6} - \frac{2}{3}$
8. $\frac{8}{9} - \frac{2}{3}$
9. $\frac{4}{5} - \frac{1}{3}$
10. $\frac{7}{8} - \frac{7}{16}$
11. $5 - \frac{3}{4}$
12. $7 - \frac{7}{8}$
13. $8 - 5\frac{5}{8}$
14. $8\frac{3}{4} - 2\frac{1}{8}$
15. $9\frac{1}{2} - 8\frac{3}{4}$
16. $9\frac{1}{3} - 8\frac{2}{3}$
17. $7\frac{7}{12} - 5\frac{1}{2}$
18. $16\frac{3}{8} - 9\frac{3}{4}$

GROUP 2

Subtract:

1. $\frac{3}{5} - \frac{1}{3}$
2. $\frac{7}{8} - \frac{3}{4}$
3. $\frac{7}{8} - \frac{5}{12}$
4. $12 - 7\frac{5}{12}$
5. $8\frac{2}{3} - \frac{3}{4}$
6. $12\frac{1}{4} - 9\frac{7}{8}$
7. $5\frac{15}{16} - 3\frac{1}{2}$
8. $76 - 35\frac{15}{16}$
9. $35\frac{15}{16} - 17$

Add vertically and subtract horizontally:

10. $12\frac{2}{3} - 4\frac{5}{6}$
$5\frac{5}{6} - 2\frac{2}{3}$
$9\frac{1}{12} - 4\frac{1}{2}$

11. $8\frac{1}{4} - 6\frac{3}{8}$
$5\frac{2}{3} - 4\frac{1}{2}$
$11\frac{5}{6} - 2\frac{1}{4}$

12. Before being sponged, a piece of cloth measured $24\frac{1}{2}$ yd. After being sponged, it measured $23\frac{5}{8}$ yd. What was the shrinkage?

13. At the beginning of an automobile trip John Stewart had $18\frac{1}{2}$ gal. of gasoline in his tank. He used $17\frac{3}{4}$ gal. and then put 15 gal. more in the tank. If he then used $12\frac{1}{2}$ gal., how many gallons should he have remaining?

14. The Dowell Trading Company shipped 3 cases whose gross weight was $257\frac{1}{4}$ lb., $285\frac{1}{2}$ lb., and $305\frac{3}{4}$ lb., respectively. If the merchandise in them weighed 780 lb., what was the weight of the cases?

15. If the depth of a page in a book is $8\frac{5}{16}$ in., and the upper and lower margins together measure $1\frac{7}{8}$ in., how many inches contain printed matter?

UNIT 4

Multiplication of Common Fractions and Mixed Numbers

Multiplying One Common Fraction by Another

EXAMPLE 1. (*a*) Multiply $\frac{1}{2}$ by $\frac{1}{4}$. (*b*) Multiply $\frac{1}{2}$ by $\frac{6}{8}$.

SOLUTION. (*a*) $\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$ (*b*) $\frac{1}{2} \times \frac{6}{8} = \dfrac{1 \times 6}{2 \times 8} = \frac{6}{16} = \frac{3}{8}$

To multiply one common fraction by another common fraction, place the product of the numerators over the product of the denominators and express the resulting fraction in its lowest terms.

Multiplying One Mixed Number by Another

EXAMPLE 2. Multiply $6\frac{3}{4}$ by $4\frac{1}{8}$.

SOLUTION.

$$6\tfrac{3}{4} = \tfrac{27}{4}$$
$$4\tfrac{1}{8} = \tfrac{33}{8}$$
$$\tfrac{27}{4} \times \tfrac{33}{8} = \tfrac{891}{32} = 27\tfrac{27}{32}$$

To multiply one mixed number by another mixed number, change the mixed numbers to improper fractions and multiply as usual.

Problems

GROUP 1

Multiply:

1. $6 \times \frac{2}{3}$
2. $3 \times \frac{5}{6}$
3. $11 \times \frac{3}{5}$
4. $7 \times \frac{5}{8}$
5. $\frac{3}{4} \times 5$
6. $\frac{1}{3} \times 8$
7. $\frac{1}{4} \times 17$
8. $\frac{3}{4} \times \frac{1}{2}$
9. $\frac{2}{3} \times \frac{5}{6}$
10. $\frac{3}{4} \times \frac{5}{7}$
11. $\frac{3}{8} \times$
12. $\frac{6}{5} \times \frac{5}{7}$
13. $\frac{1}{2} \times 7\frac{1}{3}$
14. $\frac{2}{3} \times 6\frac{1}{4}$
15. $4\frac{1}{4} \times \frac{1}{2}$

GROUP 2

Multiply:

1. $\frac{7}{12} \times 13$
2. $\frac{6}{7} \times 124$
3. $\frac{19}{22} \times 16$
4. $21 \times \frac{3}{5}$
5. $36 \times \frac{3}{8}$
6. $12\frac{1}{2} \times 10$
7. $\frac{3}{4} \times 24$
8. $20 \times \frac{5}{6}$
9. $7\frac{1}{2} \times 6$
10. $\frac{3}{5} \times 10$
11. $3\frac{1}{7} \times 6$
12. $\frac{2}{3} \times 24$

Cancellation can be defined as the process of shortening certain computations involving multiplication and division by canceling equal factors from both dividend and divisor of the fractions. It is based on the principle that the numerator and denominator of a fraction can be multiplied or divided by the same number without changing the value of the fraction.

The following suggestions should be kept in mind when you are solving problems by the cancellation method:

1. When you multiply $\frac{3}{8} \times \frac{8}{5} \times \frac{10}{6}$, you get $\frac{1}{1}$, or 1 (not zero).

2. When you remove or cancel the factors in a numerator and denominator and the result is unity, or 1, put down the $\frac{1}{1}$, as was done in our solution. The tendency is to omit this figure.

GROUP 3

Multiply, using cancellation whenever possible:

1. $8 \times 1\frac{1}{3} \times 1\frac{1}{2}$
2. $\frac{22}{7} \times \frac{3}{8} \times 1\frac{3}{4}$
3. $\$400 \times \frac{4}{100} \times \frac{1}{2}$
4. 12 ft. × $2\frac{1}{2}$ ft. × $3\frac{1}{8}$ ft.
5. $\frac{5}{6} \times 20 \times \frac{3}{8}$
6. $\frac{3}{4} \times \frac{3}{16} \times 7\frac{7}{8}$
7. $5 \times 45 \times 20\frac{5}{6}$
8. $\$100 \times \frac{6}{100} \times 6$
9. $7\frac{1}{2} \times \frac{7}{12} \times \frac{1}{16} \times \frac{5}{8}$
10. $16\frac{2}{3} \times 33\frac{1}{3} \times \frac{5}{6}$
11. $2\frac{1}{2} \times 42 \times 6\frac{2}{3} \times 18$
12. $6 \times 3\frac{1}{8} \times 3\frac{1}{2} \times 5\frac{1}{2}$
13. $\frac{8}{9} \times 2\frac{2}{3} \times 16 \times \frac{9}{16}$
14. $\frac{1}{3} \times 600 \times \frac{3}{20} \times \frac{1}{4}$
15. $\$1000 \times \frac{6}{100} \times \frac{1}{5}$
16. $\frac{3}{4} \times \frac{2}{3} \times \frac{5}{8} \times \frac{7}{16}$
17. $6\frac{7}{8} \times \frac{12}{15} \times \frac{3}{4} \times 10$
18. $4\frac{1}{8} \times \frac{11}{12} \times \frac{18}{44} \times 72$
19. $\frac{15}{16} \times 3\frac{3}{8} \times 56 \times 12\frac{7}{16}$
20. $12\frac{1}{2} \times 12\frac{1}{2} \times 12\frac{1}{2} \times 12\frac{1}{2}$

Fractions Used in Business

Invoices. Extend and total the prices of items in the following invoices.

1.

MUTUAL WHOLESALE COMPANY
CHICAGO 6, ILLINOIS

Sold to: James Wilson

Date

Terms:

Shipped via:

Quantity	*Description*	*Unit Price*	*Extension*
52 yd.	Stock #625	\$.25	
84 yd.	" 62	.12½	
144 yd.	" 15	.75	
96 yd.	" 22	.16⅔	
192 yd.	" 84	.37½	
		Total	

2.

MUTUAL WHOLESALE COMPANY
CHICAGO 6, ILLINOIS

Sold to: Joseph Girard

Date

Terms:

Shipped via:

Quantity	*Description*	*Unit Price*	*Extension*
24 yd.	Stock #65	\$.62½	
28 yd.	" 17	.37½	
32 yd.	" 24	.87½	
44 yd.	" 18	.12½	
36 yd.	" 16	.16⅔	
		Total	

3.

MUTUAL WHOLESALE COMPANY
CHICAGO 6, ILLINOIS

Sold to: John Morton
Date
Terms:
Shipped via:

Quantity	*Description*	*Unit Price*	*Extension*
412 yd.	Stock #28	$.25	
368 yd.	" 22	$.12\frac{1}{2}$	
288 yd.	" 25	$.37\frac{1}{2}$	
516 yd.	" 29	$.16\frac{2}{3}$	
198 yd.	" 34	$.33\frac{1}{3}$	
		Total	

4.

MUTUAL WHOLESALE COMPANY
CHICAGO 6, ILLINOIS

Sold to: George Scott
Date
Terms:
Shipped via:

Quantity	*Description*	*Unit Price*	*Extension*
64 lb.	Grade A	$\$.06\frac{1}{4}$	
96 lb.	" B	$.12\frac{1}{2}$	
128 lb.	" C	$.62\frac{1}{2}$	
156 lb.	" D	$.66\frac{2}{3}$	
440 lb.	" E	$.87\frac{1}{2}$	
		Total	

The Four-Step Process of Multiplying Mixed Numbers

EXAMPLE. Using the four-step method, multiply $4\frac{3}{4}$ by $6\frac{1}{2}$.

SOLUTION.

$$\begin{array}{rll} & 4\frac{3}{4} & \\ \times & \underline{6\frac{1}{2}} & \\ & \frac{3}{8} & \textit{Step 1.}\quad \frac{1}{2} \times \frac{3}{4} = \frac{3}{8} \\ & 2 & \textit{Step 2.}\quad \frac{1}{2} \times 4 = 2 \\ & 4\frac{1}{2} & \textit{Step 3.}\quad 6 \times \frac{3}{4} = 4\frac{1}{2} \\ & \underline{24} & \textit{Step 4.}\quad 6 \times 4 = 24 \\ & 30\frac{7}{8} & \end{array}$$

Problems

Multiply the following, using the above method:

1. $\begin{array}{r} 24\frac{1}{2} \\ 16\frac{2}{3} \\ \hline \end{array}$
2. $\begin{array}{r} 85\frac{3}{4} \\ 64\frac{3}{5} \\ \hline \end{array}$
3. $\begin{array}{r} 75\frac{7}{8} \\ 48\frac{2}{3} \\ \hline \end{array}$
4. $\begin{array}{r} 33\frac{1}{3} \\ 27\frac{4}{11} \\ \hline \end{array}$
5. $\begin{array}{r} 110\frac{5}{7} \\ 49\frac{1}{5} \\ \hline \end{array}$
6. $\begin{array}{r} 24\frac{2}{9} \\ 18\frac{3}{8} \\ \hline \end{array}$
7. $\begin{array}{r} 56\frac{2}{3} \\ 72\frac{5}{8} \\ \hline \end{array}$
8. $\begin{array}{r} 108\frac{5}{6} \\ 96\frac{2}{9} \\ \hline \end{array}$
9. $\begin{array}{r} 42\frac{1}{6} \\ 36\frac{3}{14} \\ \hline \end{array}$
10. $\begin{array}{r} 81\frac{3}{7} \\ 49\frac{5}{9} \\ \hline \end{array}$
11. $\begin{array}{r} 72\frac{3}{8} \\ 40\frac{5}{6} \\ \hline \end{array}$
12. $\begin{array}{r} 44\frac{1}{6} \\ 54\frac{3}{4} \\ \hline \end{array}$

UNIT 5

Division of Common Fractions and Mixed Numbers

In dividing common fractions by a common fraction or mixed number,

a. Invert the divisor and multiply:

$$\tfrac{1}{2} \div \tfrac{1}{4} \qquad \tfrac{1}{2} \times \tfrac{4}{1} = \tfrac{4}{2} = 2$$

b. Place a 1 under whole numbers:

$$6 \div \tfrac{2}{3} \qquad \tfrac{6}{1} \times \tfrac{3}{2} = 9$$

c. Change mixed numbers to improper fractions before dividing:

$$6\tfrac{1}{4} \div 2\tfrac{1}{2} \qquad \tfrac{25}{4} \div \tfrac{5}{2} \qquad \tfrac{25}{4} \times \tfrac{2}{5} = \tfrac{50}{20} = 2\tfrac{1}{2}$$

Problems

Group 1

Divide:

1. $\frac{6}{7} \div 3$
2. $\frac{4}{5} \div 2$
3. $\frac{3}{8} \div 2$
4. $\frac{4}{9} \div 3$
5. $\frac{5}{6} \div 2$
6. $\frac{1}{3} \div \frac{1}{2}$
7. $\frac{3}{4} \div \frac{1}{2}$
8. $\frac{3}{5} \div \frac{1}{3}$
9. $\frac{5}{6} \div \frac{1}{2}$
10. $\frac{7}{8} \div \frac{1}{4}$
11. $1 \div \frac{5}{8}$
12. $1 \div \frac{5}{6}$
13. $4 \div \frac{5}{6}$
14. $3 \div \frac{1}{4}$
15. $20 \div \frac{1}{4}$
16. $150\frac{3}{8} \div 3$

Group 2

Divide:

1. $\frac{4}{7} \div 2$
2. $\frac{15}{21} \div 5$
3. $\frac{7}{9} \div 5$
4. $\frac{3}{11} \div 6$
5. $\frac{3}{7} \div \frac{2}{3}$
6. $\frac{4}{9} \div \frac{3}{8}$
7. $\frac{8}{9} \div \frac{1}{6}$
8. $\frac{7}{12} \div \frac{5}{8}$
9. $8 \div \frac{2}{5}$
10. $16 \div \frac{8}{9}$
11. $21 \div \frac{3}{7}$
12. $7 \div \frac{2}{4}$
13. $8\frac{4}{9} \div 2\frac{2}{3}$
14. $18\frac{1}{4} \div 3\frac{5}{8}$
15. $24\frac{2}{3} \div 5$
16. $39\frac{3}{8} \div 6\frac{2}{3}$

17. Why is $3 \div \frac{1}{4}$ three times as large a number as $1 \div \frac{1}{4}$? Prove your answer by means of a diagram.

Chapter Test—Review

Express as improper fractions:

1. $3\frac{1}{2}$
2. $5\frac{2}{7}$
3. $6\frac{1}{8}$
4. $9\frac{7}{8}$
5. $8\frac{1}{3}$
6. $5\frac{1}{6}$
7. $25\frac{1}{4}$
8. $12\frac{3}{4}$
9. $16\frac{5}{6}$
10. $7\frac{3}{8}$

Express as whole or mixed numbers:

11. $\frac{12}{3}$
12. $\frac{16}{12}$
13. $\frac{37}{3}$
14. $\frac{31}{9}$
15. $\frac{10}{4}$
16. $\frac{24}{5}$
17. $\frac{38}{6}$
18. $\frac{37}{3}$
19. $\frac{16}{6}$
20. $\frac{19}{2}$

Add:

21. $\begin{array}{r}\frac{2}{3}\\ \frac{3}{4}\\ \frac{1}{2}\\ \hline\end{array}$
22. $\begin{array}{r}\frac{7}{10}\\ \frac{1}{3}\\ \frac{2}{5}\\ \hline\end{array}$
23. $\begin{array}{r}\frac{11}{12}\\ \frac{4}{9}\\ \frac{5}{6}\\ \hline\end{array}$
24. $\begin{array}{r}\frac{13}{4}\\ 2\frac{1}{2}\\ 1\frac{7}{8}\\ \hline\end{array}$
25. $\begin{array}{r}\frac{1}{3}\\ \frac{1}{12}\\ \frac{3}{8}\\ \hline\end{array}$

26. $\begin{array}{r}5\frac{5}{6}\\ 8\frac{1}{3}\\ 3\frac{1}{2}\\ \hline\end{array}$
27. $\begin{array}{r}2\frac{5}{12}\\ 3\frac{2}{3}\\ 14\frac{7}{24}\\ \hline\end{array}$
28. $\begin{array}{r}15\frac{11}{16}\\ 24\frac{7}{12}\\ 38\frac{13}{24}\\ \hline\end{array}$
29. $\begin{array}{r}32\frac{3}{8}\\ 24\frac{1}{2}\\ 7\frac{4}{5}\\ \hline\end{array}$
30. $\begin{array}{r}8\frac{1}{12}\\ 26\frac{5}{6}\\ 9\frac{7}{10}\\ \hline\end{array}$

Subtract:

31. $\begin{array}{r}6\\ 3\frac{3}{4}\\ \hline\end{array}$
32. $\begin{array}{r}8\frac{1}{3}\\ 2\frac{5}{12}\\ \hline\end{array}$
33. $\begin{array}{r}14\frac{2}{3}\\ 8\frac{7}{8}\\ \hline\end{array}$
34. $\begin{array}{r}\frac{3}{4}\\ \frac{3}{8}\\ \hline\end{array}$
35. $\begin{array}{r}\frac{15}{16}\\ \frac{29}{32}\\ \hline\end{array}$

36. $\begin{array}{r}18\frac{2}{11}\\ 9\frac{8}{33}\\ \hline\end{array}$
37. $\begin{array}{r}13\frac{1}{3}\\ 3\frac{4}{5}\\ \hline\end{array}$
38. $\begin{array}{r}12\frac{1}{2}\\ 6\frac{3}{16}\\ \hline\end{array}$
39. $\begin{array}{r}80\frac{1}{6}\\ 45\frac{3}{10}\\ \hline\end{array}$
40. $\begin{array}{r}38\frac{3}{7}\\ 17\frac{5}{28}\\ \hline\end{array}$

Multiply:

41. $\frac{4}{7} \times \frac{5}{9}$
42. $\frac{6}{11} \times \frac{3}{4}$
43. $8\frac{4}{7} \times \frac{4}{13}$
44. $5\frac{1}{3} \times 6\frac{1}{2}$
45. $18\frac{3}{4} \times \frac{7}{8}$
46. $\frac{2}{3} \times 7\frac{1}{2} \times 8$
47. $16 \times \frac{5}{12} \times \frac{1}{3}$
48. $\frac{2}{3} \times 5\frac{6}{7} \times 8\frac{3}{10}$

Multiply by the four-step method:

49. $56\frac{5}{6} \times 42\frac{5}{8}$
50. $15\frac{3}{7} \times 42\frac{3}{5}$

Divide:

51. $100 \div 14\frac{2}{7}$
52. $20 \div \frac{3}{4}$
53. $16\frac{2}{3} \div \frac{5}{16}$
54. $6\frac{1}{4} \div 8\frac{2}{3}$
55. $\frac{7}{8} \div 2\frac{1}{2}$
56. $24\frac{7}{8} \div 6\frac{8}{13}$
57. $65 \div 2\frac{9}{10}$
58. $8\frac{1}{3} \div 100$
59. $18\frac{3}{4} \div 6\frac{7}{12}$
60. $\frac{5}{8} \div 2\frac{1}{2}$

Chapter 4

Decimal Fractions

UNIT 1

Reading and Writing Decimal Fractions

DECIMAL FRACTIONS are expressed in tenths, hundredths, thousandths, and so forth.

In a decimal fraction, the denominator is not written as in a common fraction; instead, it is indicated by means of a decimal point. Thus, one tenth ($\frac{1}{10}$) is written .1; seven tenths ($\frac{7}{10}$) is written .7; eight hundredths ($\frac{8}{100}$) is written .08; twenty-three hundredths ($\frac{23}{100}$) is written .23; fifteen thousandths ($\frac{15}{1000}$) is written .015; and three hundred seventy-five thousandths ($\frac{375}{1000}$) is written .375.

To express tenths, one place is pointed off, as in .7.

To express hundredths, two places are pointed off, as in .08.

To express thousandths, three places are pointed off, as in .375.

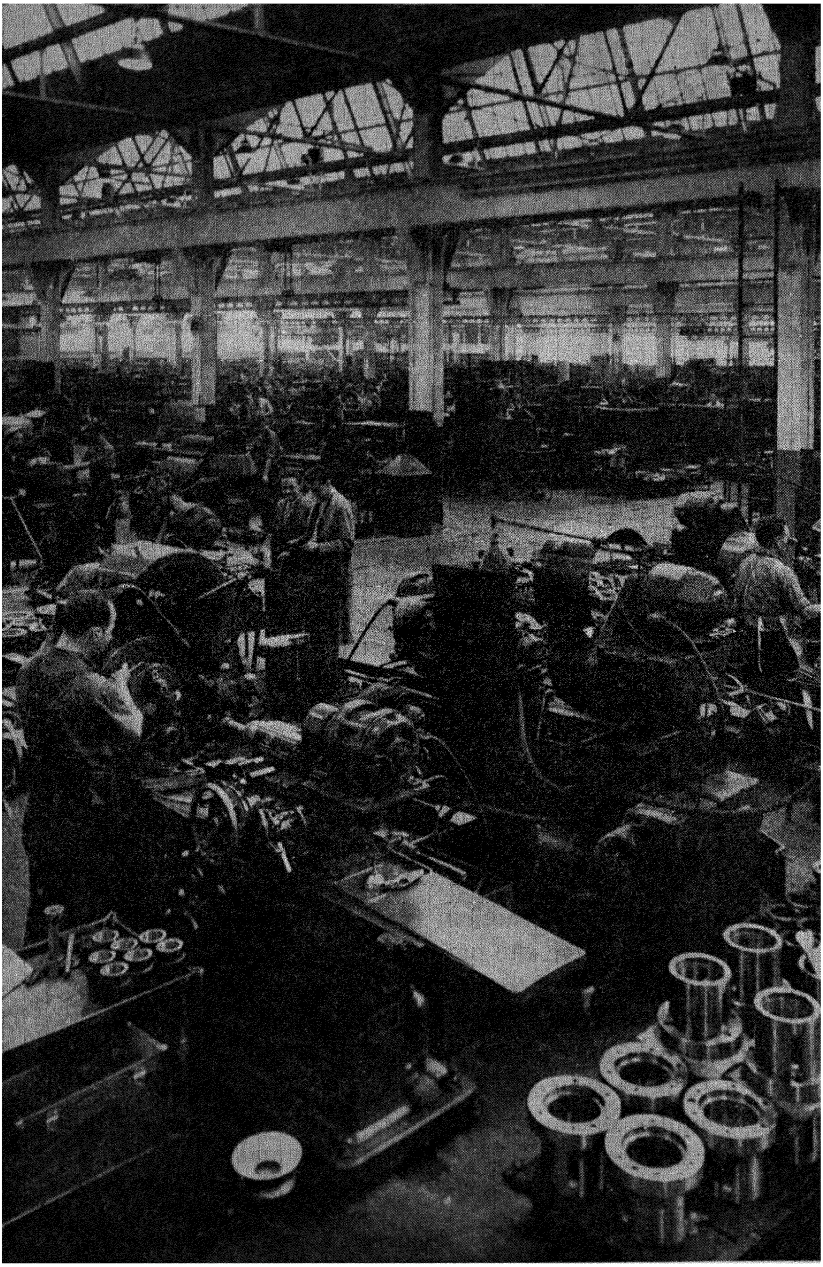
To express ten-thousandths, four places are pointed off, as in .4265.

To read a decimal fraction, read the number as if it were an integer, and then give the name of the last decimal order that the last digit of the number occupies. For example, 0.5075 is read "five thousand seventy-five ten-thousandths." It should be remembered that, in reading numbers containing decimals, the word *and* is used only between the whole number and the decimal part, or, in complex decimals, between the decimal and the common fraction. For example, 5.07 is read "five and seven hundredths," and 0.3½ is read "three and one half tenths."

Problems

Read the following decimals:

1. .2
2. .8
3. .27
4. .48
5. .006
6. .023
7. .327
8. .406
9. .5268
10. .1204
11. .0001
12. .0026



Warner & Swasey

A Machine Shop. In this shop are manufactured parts for machine tools. Decimals are important here because parts must be made to specifications of thousandths of an inch.

13. .0185
14. .3428
15. .5642
16. .00005
17. .00012
18. .00147
19. .01528
20. .11642
21. .000004
22. .000028
23. .000152
24. .001627
25. .084972
26. .111226
27. 1.1
28. 7.25
29. 16.475
30. 25.037
31. 430.0287
32. 26.0003
33. 328.28
34. 5462.2645
35. 49,168.238
36. 1000.001
37. 1.0001
38. 58.0274
39. 1684.003
40. 1210.0014

Write the following as decimal fractions:

1. six tenths
2. forty-six thousandths
3. two hundredths
4. four and nine ten-thousandths
5. seven and eight tenths
6. forty-two and one hundred fifty-five ten-thousandths
7. one million and one millionth
8. five hundred thousandths
9. sixty-six and two hundred twenty thousandths
10. nine hundred and fifty-six hundred-thousandths

Reduction of Common Fractions to Decimals

The decimal equivalents of frequently used common fractions, such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{12}$, and their multiples, should be memorized so that they can be given at sight. (See the table on the following page.)

The following problem illustrates a case in which some computation is necessary in changing a common fraction to its decimal equivalent:

Example. Change $\frac{4}{7}$ to a decimal.

Solution.

$$\begin{array}{r} .571\frac{3}{7} \\ 7\overline{)4.000} \\ \underline{35} \\ 50 \\ \underline{49} \\ 10 \\ \underline{7} \\ 3 \end{array}$$

To change a common fraction to a decimal fraction, annex zeros to the numerator (after the decimal point) and divide by the denominator. In the problem above, the decimal was carried to three places, which are usually enough. If an absolutely accurate answer is required, the fraction must be retained; that is, in our problem the accurate result is $.57\frac{1}{7}$ or $.571\frac{3}{7}$, depending on whether the decimal is carried to two or to three places. For most practical purposes, however, the answer obtained by expressing the last digit in the decimal as the nearest integer—that is, in our problem, .57 or .571—is sufficient.

Problems

Express as decimal fractions. Carry to two decimal places and show the remainder, if any, as a common fraction:

1. $\frac{6}{25}$
2. $\frac{5}{13}$
3. $\frac{13}{18}$
4. $\frac{7}{50}$
5. $\frac{9}{15}$
6. $\frac{14}{24}$
7. $\frac{6}{200}$
8. $\frac{11}{18}$
9. $\frac{3}{7}$
10. $\frac{24}{32}$
11. $\frac{6}{31}$
12. $\frac{13}{22}$

UNIT 2

Aliquot Parts

An aliquot part is any sum which is contained in a dollar, or 100, an exact number of times. For instance, $12\frac{1}{2}$¢ is contained exactly eight times in one dollar, making it equal to one eighth of a dollar. Twenty-five cents is contained exactly four times in one dollar, making it equal to one fourth of a dollar. The following table gives the aliquot parts of $1.00 or 1 which are most commonly used. They should be memorized.

Halves: $\frac{1}{2} = .50$
Thirds: $\frac{1}{3} = .33\frac{1}{3}$; $\frac{2}{3} = .66\frac{2}{3}$
Fourths: $\frac{1}{4} = .25$; $\frac{3}{4} = .75$
Fifths: $\frac{1}{5} = .20$; $\frac{2}{5} = .40$; $\frac{3}{5} = .60$; $\frac{4}{5} = .80$
Sixths: $\frac{1}{6} = .16\frac{2}{3}$; $\frac{5}{6} = .83\frac{1}{3}$
Sevenths: $\frac{1}{7} = .14\frac{2}{7}$
Eighths: $\frac{1}{8} = .12\frac{1}{2}$; $\frac{3}{8} = .37\frac{1}{2}$; $\frac{5}{8} = .62\frac{1}{2}$; $\frac{7}{8} = .87\frac{1}{2}$
Ninths: $\frac{1}{9} = .11\frac{1}{9}$
Tenths: $\frac{1}{10} = .10$
Elevenths: $\frac{1}{11} = .09\frac{1}{11}$
Twelfths: $\frac{1}{12} = .08\frac{1}{3}$
Sixteenths: $\frac{1}{16} = .06\frac{1}{4}$

Aliquot Parts of 100%

Here are the aliquot parts of 100% that are most commonly used in business: $\frac{1}{2} = 50\%$; $\frac{1}{3} = 33\frac{1}{3}\%$; $\frac{1}{4} = 25\%$; $\frac{1}{5} = 20\%$; $\frac{1}{6} = 16\frac{2}{3}\%$; $\frac{1}{8} = 12\frac{1}{2}\%$.

Using the equivalents in per cent of such fractions as $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, and $\frac{1}{8}$, you can find the equivalents in per cent of such fractions as $\frac{2}{3}$, $\frac{3}{4}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{5}{6}$, $\frac{3}{8}$, $\frac{5}{8}$, and $\frac{7}{8}$. How?

The equivalents in per cent of such fractions as $\frac{7}{20}$, $\frac{7}{25}$, $\frac{5}{16}$, and others should be computed when needed, but it is not necessary to memorize them.

Problems

Write the following per cents as common fractions or mixed numbers:

1. 30%
2. .3%
3. 45%
4. 125%
5. 200%
6. $87\frac{1}{2}\%$
7. $12\frac{1}{2}\%$
8. 10%
9. 110%
10. 70%
11. $37\frac{1}{2}\%$
12. .5%
13. $\frac{1}{2}\%$
14. 250%
15. $16\frac{2}{3}\%$
16. $14\frac{2}{7}\%$
17. $133\frac{1}{3}\%$
18. 40%
19. $266\frac{2}{3}\%$
20. $66\frac{2}{3}\%$
21. $83\frac{1}{3}\%$
22. .05%
23. .002%
24. .75%

UNIT 3

Recognizing the Similarity of Common and Decimal Fractions

Fill in the missing numbers in the following problems:

1. $\frac{1}{2} = \frac{?}{100} = .50$
2. $\frac{7}{8} = \frac{875}{1000} = ?$
3. $\frac{?}{4} = \frac{75}{100} = .75$
4. $\frac{4}{5} = \frac{?}{100} = .80$
5. $\frac{?}{8} = \frac{625}{1000} = .625$
6. $\frac{1}{7} = \frac{?}{100} = .14\frac{2}{7}$
7. $\frac{?}{16} = \frac{6\frac{1}{4}}{100} = .06\frac{1}{4}$
8. $\frac{1}{9} = \frac{11\frac{1}{9}}{100} = ?$
9. $\frac{?}{6} = \frac{16\frac{2}{3}}{100} = .16\frac{2}{3}$
10. $\frac{2}{3} = \frac{66\frac{2}{3}}{100} = ?$
11. $\frac{?}{3} = \frac{33\frac{1}{3}}{100} = .33\frac{1}{3}$
12. $\frac{1}{4} = \frac{25}{100} = ?$
13. $\frac{5}{6} = \frac{?}{100} = .83\frac{1}{3}$
14. $\frac{?}{12} = \frac{8\frac{1}{3}}{100} = .08\frac{1}{3}$
15. $\frac{3}{8} = \frac{375}{1000} = ?$

Recognizing the Relative Value of Decimals

Problems

Arrange the three numbers in each group according to their size, largest to smallest:

1. .5 .55 .555
2. .3 .28 .325
3. .275 .30 .045
4. .38 3.3 .456
5. .542 .6 .605
6. .8 .79 .81
7. .07 .065 .08
8. .1 .15 .015
9. .232 .235 .238
10. .226 22.6 2.26
11. .35 $\frac{1}{3}$ .32
12. .25 .4 .256
13. $\frac{2}{5}$ .35 .42
14. .12 $\frac{1}{8}$ .11
15. .8 .88 $\frac{7}{8}$

UNIT 4

Rounding Off Decimals

In business practice, rounding off decimals is usually confined to cents. Any fraction of a cent may be counted as a whole cent

In figuring interest, however, half of a cent or more, is counted as one cent.

EXAMPLE. $5.456 = $5.46
$3.834 = $3.83

The same principle applies in rounding off decimals to the nearest tenth, thousandth, or any other place.

EXAMPLES.
.14 to the nearest tenth is .1
.145 to the nearest hundredth is .15
.1456 to the nearest thousandth is .146
.14563 to the nearest ten-thousandth is .1456
.145637 to the nearest hundred-thousandth is .14564

Problems

GROUP 1

Round off each decimal to the nearest tenth:

1. .11
2. .45
3. .73
4. .68
5. .14
6. .07
7. .09
8. .03
9. 1.08
10. .95
11. .32
12. .15
13. 1.9
14. 2.33
15. 5.04
16. .35
17. .79
18. .46
19. .64
20. .06

GROUP 2

Round off each decimal to the nearest hundredth:

1. .228
2. .467
3. .035
4. .291
5. .006
6. .666
7. .742
8. .654
9. .406
10. .047
11. .009
12. 1.999
13. 2.095
14. 3.085
15. 10.016
16. .177
17. .954
18. 1.697
19. 5.005
20. 1.496

GROUP 3

Round off each decimal to the nearest thousandth:

1. .9824
2. .1705
3. .6616
4. .3564
5. .6918
6. .0965
7. .0076
8. .0197
9. .0008
10. .0016
11. .1761
12. .8998
13. .2238
14. .9874
15. .9999
16. .4005
17. .8060
18. .9756
19. .0127
20. .2095

UNIT 5
Addition of Decimals

ADDITION of decimals is used in such practical problems as finding the amount of a customer's purchases, finding the total amount of sales made by a salesman during a given period, finding the amount of sales made by each department or by all departments of a store, finding the total amount of daily bank deposits, and finding the total amount of a family's weekly expenditures.

The process of adding dollars and cents, or *mixed decimals,* as they are called technically, is the same as that of adding whole numbers, as we shall see in the following problem:

Example. The sales of a retail drugstore during a certain week were as follows: Monday, \$85.75; Tuesday, \$75.34; Wednesday, \$84.08; Thursday, \$92.86; Friday, \$57.39; Saturday, \$165.85. Find the total sales for the week.

Solution.

$ 85.75
75.34
84.08
92.86
57.39
165.85

$561.27, total sales for week.

Adding Whole Numbers and Decimals

To add whole numbers and decimals, place the numbers in a column so that the decimal points are aligned, and add as if the numbers were whole numbers. Place the decimal point in the result directly under the points in the numbers added.

Example. Find the sum of 25.064, .728, 5.4, .001, .3286, 648.

Solution.

25.064
.728
5.4
.001
.3286
648.

679.5216

Problems

Copy the following problems in columns and add:

1. 3.3 + 15.4 + 7.2
2. 2.6 + 8.08
3. 5.25 + 7.45
4. 9.35 + 8.65
5. 5.45 + 9.75
6. \$7.35 + \$12.58

7. \$15.06 + \$7.67
8. \$18.79 + \$11.53
9. 2.57 + 9.40 + 25.63 + 71.84
10. 15.06 + 56.03 + 6.31 + 18.07 + 35.38
11. 805.63 + 97.36 + 801.50 + 64.35
12. 1735.05 + 3405.35 + 407.86 + 371.26
13. 6.008 + 45.45 + 8.0072 + 12.64 + 8.325
14. 45.16 + 28.32 + .6538 + .0024 + 5.6
15. 328.9 + 91.056 + 18.02 + 9.68 + .013
16. \$28.53 + \$.45 + \$9.60 + \$.98 + \$1.05
17. .667 + 9.125 + 3.40 + 216.8 + .83
18. 6.13 + 9.444 + .832 + 5.76 + 9.148
19. .155 + 2.0467 + 16.047 + .705 + 6.003
20. 10.08 + 80.06 + 800.009 + .0643 + 2.87
21. 64.02 + .64738 + .001 + .1675 + .0911
22. 76.00 + 842.6 + 674.32 + 58.465 + 8.7683
23. 6.375 + 5.8 + 21.425 + 13.4 + 51.75
24. 37.5 + 54.125 + 57.025 + 3.2875 + 14.6

Complete the following record of sales:

Day	*Men's Haberdashery*	*Shoes*	*Ladies' Department*	*House Furnishings*	*Total*
Monday...........	\$123.65	\$ 74.83	\$205.15	\$140.25	\$
Tuesday...........	85.72	65.75	162.84	182.72	
Wednesday........	204.35	105.22	184.75	204.65	
Thursday..........	147.61	98.70	105.30	167.82	
Friday............	89.35	102.10	89.00	195.43	
Saturday..........	306.25	154.15	205.18	435.50	
Totals.........	\$	\$	\$	\$	\$

UNIT 6

Adding Whole Numbers and Complex Decimals

Example. (*a*) Add $37.42\frac{1}{5}$, $15.7\frac{3}{4}$, $125.3\frac{7}{8}$, and $29.087\frac{1}{4}$. (*b*) Add $12.3\frac{1}{3}$, $17.85\frac{1}{6}$, $375.9\frac{4}{9}$, and $54.08\frac{2}{3}$.

Solution.

(*a*)

$$\begin{array}{rcr} 37.42\frac{1}{5} & = & 37.422 \\ 15.7\frac{3}{4} & = & 15.775 \\ 125.3\frac{7}{8} & = & 125.3875 \\ 29.087\frac{1}{4} & = & \underline{29.08725} \\ & & 207.67175 \end{array}$$

(*b*)

$$\begin{array}{rcr} 12.3\frac{1}{3} & = & 12.3333 \\ 17.85\frac{1}{6} & = & 17.8517 \\ 375.9\frac{4}{9} & = & 375.9444 \\ 54.08\frac{2}{3} & = & \underline{54.0867} \\ & & 460.2161, \text{ or } 460.216 \end{array}$$

Carry out the extensions to one more than the number of places required in the answer.

To add whole numbers and complex decimals extend the complex decimal until the fractions are removed or the decimals are extended the same number of places; and then add in the usual way. Place the result in position, and round it off to the required number of places.

Problems

GROUP 1

Add the following whole numbers and complex decimals:

1. $3.7\frac{1}{8} + 14.3\frac{7}{8} + 23.66\frac{3}{4} + 51.28\frac{3}{5}$
2. $8.11\frac{1}{3} + 73.84\frac{1}{6} + 67.025\frac{1}{2} + 9.03\frac{1}{12}$
3. $37.92\frac{2}{3} + 43.08\frac{3}{25} + 12.69\frac{1}{6} + 93.42\frac{5}{8}$
4. $84.32\frac{1}{5} + 17.8\frac{3}{4} + 135.3\frac{7}{8} + 89.067\frac{1}{4}$
5. $.37\frac{1}{2} + .5\frac{1}{16} + 24.62\frac{1}{2} + 48.6\frac{3}{8}$
6. $.14\frac{2}{7} + .32\frac{3}{8} + .08\frac{1}{3} + 27.9\frac{7}{8}$
7. $8.4\frac{5}{8} + \frac{5}{6} + 7.01\frac{3}{5} + 42\frac{2}{3}$
8. $.08\frac{1}{3} + 4.6\frac{1}{9} + 82.2\frac{1}{11} + 6.25\frac{1}{4}$
9. $16.2\frac{5}{16} + .29\frac{1}{4} + .75\frac{3}{10} + .78\frac{2}{3} + .06\frac{1}{8}$
10. $4.6\frac{2}{3} + 87.87\frac{1}{2} + 5.09\frac{1}{12} + 28.76\frac{1}{7}$

GROUP 2

Solve the following problems:

1. A business firm made the following daily deposits in the bank: $1262.84, $876.45, $2842.96, $3416.27, $4962.84. What were the total deposits for the week?

2. A set of gauges had the following thicknesses: .025, .020, .1013, .012, .008, .016, .004, .003. What is the total thickness of all the gauges?

3. A man made five trips in his automobile with the following number of miles for each trip: 68.4, 126.7, 45.9, 232.6, and 65.3. How many miles did he travel?

4. Add the following: four and eight tenths, thirty-two and sixty-seven thousandths, seventeen and seven ten-thousandths, four hundred and four hundred-thousandths.

5. The inside diameter of a pipe is 1.462″ and the thickness is $\frac{3}{16}$″. What is the total diameter of the pipe?

UNIT 7

Subtraction of Decimals

To SUBTRACT whole numbers and simple decimals, place the subtrahend under the minuend with the decimal points in alignment and subtract as if the numbers were whole numbers. Place the decimal point in the remainder directly under the points in the minuend and subtrahend.

EXAMPLE. Subtract 6.0189 from 12.643.

SOLUTION.

$$\begin{array}{r} 12.6430 \\ \underline{6.0189} \\ 6.6241 \end{array}$$

Problems

Copy and subtract the following:

1. .6 − .2
2. .68 − .47
3. 6.2 − 5.4
4. 8 − 5.2
5. .425 − .38
6. 19.4 − 15.6
7. 5.06 − 1.8
8. .6 − .45
9. 9.36 − 7.48
10. .400 − .275
11. $16 − $.75
12. $500 − $46.65
13. $54 − $10.86
14. $4 − $1.36
15. 7.5 − 1.264
16. 600 − 502.999
17. 10 − 7.8
18. .894 − .765
19. 50.87 − 6.4
20. 4000.00 − 2864.376

UNIT 8

Subtracting Whole Numbers and Complex Decimals

EXAMPLE. (*a*) From $37.5\frac{1}{8}$ take 12.375. (*b*) From $49.3\frac{1}{16}$ take $31.57\frac{2}{15}$.

SOLUTION.

$$(a)\quad \begin{array}{rl} 37.5\frac{1}{8} = & 37.5125 \\ & \underline{12.3750} \\ & 25.1375\text{, or } 25.138 \end{array} \qquad (b)\quad \begin{array}{rl} 49.3\frac{1}{16} = & 49.3063 \\ 31.57\frac{2}{15} = & \underline{31.5713} \\ & 17.7350\text{, or } 17.735 \end{array}$$

To subtract whole numbers and complex decimals extend the decimals to one more than the number of places required in the answer, and then subtract in the usual way.

Problems

GROUP 1

Subtract the following whole numbers and decimals:

$$\textbf{1.}\ \begin{array}{r} 786.62\frac{5}{8} \\ \underline{489.37\frac{1}{2}} \end{array} \qquad \textbf{2.}\ \begin{array}{r} 7.7\frac{3}{8} \\ \underline{3.23\frac{5}{16}} \end{array} \qquad \textbf{3.}\ \begin{array}{r} 4.78\frac{1}{3} \\ \underline{1.24\frac{1}{12}} \end{array} \qquad \textbf{4.}\ \begin{array}{r} 25.42\frac{1}{2} \\ \underline{16.37\frac{1}{4}} \end{array}$$

5. $25.75\frac{5}{12}$	**6.** $45.62\frac{1}{4}$	**7.** $8.47\frac{1}{3}$	**8.** $15.68\frac{1}{5}$
$13.42\frac{1}{16}$	$37.73\frac{5}{6}$	$5.58\frac{2}{3}$	$4.59\frac{3}{8}$
9. $82.21\frac{1}{7}$	**10.** $27\frac{5}{6}$	**11.** $72.18\frac{1}{2}$	**12.** $81.91\frac{1}{9}$
$14.33\frac{1}{9}$	$14.25\frac{1}{4}$	$27.30\frac{7}{8}$	$69.43\frac{5}{16}$

GROUP 2

Find the balance in each of the following:

	Balance Brought Forward	*Checks Drawn*
1.	$1359	$45.70, $39.65, $175
2.	$2985.75	$175, $35.80, $187.85
3.	$3472.40	$22.50, $124.75, $195.25

	Balance Brought Forward	*Deposits*	*Checks Drawn*
4.	$2375.65	$1582.82	$17.85, $121.92, $6.81, $205.43, $75
5.	$3563.70	$789.34	$90.70, $80.06, $7.03, $149.72, $8

UNIT 9

Multiplying Decimals

TO MULTIPLY one decimal by another decimal, multiply in the usual way and point off as many places in the product as there are places pointed off in both the multiplicand and the multiplier.

EXAMPLES.

$$\begin{array}{r} 5.683 \\ \underline{\times .07} \\ .39781 \end{array} \qquad \begin{array}{r} .325 \\ \underline{.024} \\ 1300 \\ \underline{650} \\ .0078\cancel{0}\cancel{0} \end{array}$$

If necessary, zeros are prefixed to the product to obtain the required number of decimal places; zeros at the end of a decimal are dropped.

Problems

GROUP 1

Multiply the following:

1. 4.5 × .002
2. .6 × 1.75
3. 1.9 × .32
4. .004 × .004
5. 2.01 × .13
6. .08 × 1.06
7. .27 × .0008
8. 9.3 × .33
9. 85.6 × .003
10. .382 × .06
11. .902 × 1.67
12. .680 × .706
13. 75.1 × 2.3
14. 46 × 1.006
15. 3.48 × .8
16. 5.8 × .63
17. .92 × 4.1
18. .004 × 3.5
19. .032 × .017
20. 20.9 × .53
21. .532 × .08
22. 1.1 × 27.4
23. .95 × .043
24. .035 × 5.9
25. .009 × .56
26. 7.5 × .038
27. .0036 × .0033
28. .00345 × .007
29. 111.22 × .22
30. .763 × .0006

GROUP 2

1. What is the total cost of 1000 articles at $3.54 each?

2. A factory sold 10,524 machines in one year at $100 each. What was the amount of the total sales?

3. What is the total cost of six dozen articles at 33$\frac{1}{3}$¢ each?

4. What is the total cost of 7540 toys at $1.25 each?

5. If a sheet of steel is .002 inch thick, what is the height of a pile of 10,250 sheets?

6. One inch equals 2.54 centimeters. How many centimeters are there in one yard?

7. Find the cost of 11,560 pounds of coal at $12.20 per ton.

8. What would 580 feet of lumber cost at $9.30 per M?

9. If the state tax on a certain article is 2$\frac{3}{4}$¢, what is the total tax on 27,600 articles?

10. A man is paid at the rate of 1.87\frac{1}{2}$ per hour. How much would he earn in a 40-hour week?

UNIT 10

Multiplying by Using Aliquot Parts

EXAMPLE. Multiply 328 by .12$\frac{1}{2}$.

SOLUTION.

$$\overset{41}{\cancel{328}} \times \frac{1}{\cancel{8}} = 41$$

EXAMPLE. Multiply 625 by 1.20.

SOLUTION.

$$\overset{125}{\cancel{625}} \times \frac{6}{\cancel{5}} = 750$$

Problems

Multiply, using the above method:

1. $48 \times .50$
2. $128 \times .75$
3. $375 \times .80$
4. $208 \times .12\frac{1}{2}$
5. $434 \times .14\frac{2}{7}$
6. $144 \times .08\frac{1}{3}$
7. $84 \times .66\frac{2}{3}$
8. $37.5 \times .40$
9. $62.4 \times .83\frac{1}{3}$
10. $81 \times .11\frac{1}{9}$
11. $282 \times .33\frac{1}{3}$
12. $3.12 \times .16\frac{2}{3}$
13. $3.75 \times .20$
14. $112 \times .06\frac{1}{4}$
15. $3.28 \times .25$
16. $66 \times .09\frac{1}{11}$
17. $57.6 \times .87\frac{1}{2}$
18. $80 \times .60$
19. $360 \times .37\frac{1}{2}$
20. $600 \times .62\frac{1}{2}$
21. 256×1.25
22. $96 \times 2.16\frac{2}{3}$
23. $8.48 \times 3.37\frac{1}{2}$
24. $120 \times 1.08\frac{1}{3}$
25. $336 \times 2.66\frac{2}{3}$
26. 140×1.2
27. $72.9 \times 4.11\frac{1}{9}$
28. $496 \times 1.12\frac{1}{2}$
29. $2.22 \times 2.33\frac{1}{3}$
30. 33.5×5.6

UNIT 11

Multiplying a Number by 10, 100, and 1000

To MULTIPLY the number by 10, move the decimal point one place to the right; by 100, two places; and by 1000, three places. Add zeros if necessary.

EXAMPLE.

$3.24 \times 10 = 32.4$

$3.24 \times 100 = 324$

$3.24 \times 1000 = 3240$

Problems

Multiply by 10, 100, and 1000 by moving the decimal point:

1. .5
2. .25
3. .255
4. .15
5. .02
6. .0875
7. .44
8. 6.28
9. .001
10. 19.4
11. .32654
12. 2.5876
13. 25.344
14. 186.5
15. 3.1416
16. .5255
17. .3746
18. .18433
19. .23827
20. .42606
21. 4.55
22. 26.175
23. 32.989
24. 44.4567
25. .02765

UNIT 12

Multiplying Complex Decimals

EXAMPLE. Multiply $23.7\frac{1}{2}$ by $7.34\frac{7}{8}$.

SOLUTION.

$23.7\frac{1}{2} = 23.75$

$7.34\frac{7}{8} = 7.34875$

```
     7.34875
       23.75
     -------
     3674375
    5144125
   2204625
  1469750
 -----------
 174.5328125
```

PROOF.

$$23.7\frac{1}{2} \times 7.34\frac{7}{8} =$$

$$\frac{47.5}{2} \times \frac{58.79}{8} =$$

$$\frac{2792.525}{16} = 174.5328125$$

In multiplying complex decimals, remove the fractions, if possible, by extending the decimals, or change the complex decimals to improper fractions as if they were simple mixed numbers.

Problems

Multiply the following whole numbers and decimals:

1. $7.52\frac{1}{6} \times 3.4\frac{1}{3}$
2. $5.735 \times .08\frac{1}{3}$
3. $3.48\frac{1}{12} \times .32\frac{5}{6}$
4. $.637\frac{1}{4} \times 2.34\frac{1}{8}$
5. $3.45\frac{1}{2} \times .006\frac{7}{8}$
6. $5.82\frac{4}{5} \times .817\frac{1}{2}$
7. $1.14\frac{5}{8} \times 2.7\frac{3}{4}$
8. $.32\frac{1}{3} \times 45\frac{5}{6}$
9. $2.8\frac{1}{9} \times .06\frac{1}{11}$
10. $27.62\frac{3}{4} \times .003\frac{5}{8}$

UNIT 13

Multiplication Used in Business

Problems

GROUP 1

Make the extensions and find the totals:

1. 52 yd. @ $.25 = $
84 yd. @ $.12\frac{1}{2}$ =
144 yd. @ .75 =
96 yd. @ $.16\frac{2}{3}$ =
192 yd. @ $.37\frac{1}{2}$ =
Total $

2. 412 yd. @ $7\frac{1}{2}$¢ = $
368 yd. @ $12\frac{1}{2}$¢ =
288 yd. @ $37\frac{1}{2}$¢ =
516 yd. @ $16\frac{2}{3}$¢ =
198 yd. @ $33\frac{1}{3}$¢ =
Total $

3. 24 yd. @ $ $.62\frac{1}{2}$ = $
28 yd. @ $.37\frac{1}{2}$ =
32 yd. @ $.87\frac{1}{2}$ =
44 yd. @ $.12\frac{1}{2}$ =
36 yd. @ $.16\frac{2}{3}$ =
Total $

4. 64 lb. @ $6\frac{1}{4}$¢ = $
96 lb. @ $12\frac{1}{2}$¢ =
128 lb. @ $62\frac{1}{2}$¢ =
156 lb. @ $66\frac{2}{3}$¢ =
440 lb. @ $62\frac{1}{2}$¢ =
Total $

GROUP 2

Find the amount of each sale and the total sales for each department:

Department A

1. 12 Kitchen Wall Clocks.............	@ $6.60 each
2. 14 Alarm Clocks....................	@ $4.75 each
3. 8 Metal Electric Wall Clocks........	@ $8.50 each
4. 6 Eight-day Mantel Clocks..........	@ $19.95 each
5. 7 Travel Alarm Clocks.............	@ $5.85 each

Department B

1. 16 Brief Bags................ @ $3.85 each
2. 8 Doz. Pencils................ @ $ .65 dozen
3. 5 sets Water Colors........... @ $1.45 set
4. 24 Liquid Lead Pencils........ @ 3 for $.75
5. 15 School Bags............... @ 2 for $.55

Department C

1. 8 Flash Cameras.............. @ $13.65 each
2. 15 Miniature Cameras......... @ $ 7.95 each
3. 9 doz. Flashbulbs............. @ $ .85 dozen
4. 18 rolls #120 Color Film....... @ $ 1.25 roll
5. 22 rolls #620 Film............. @ $ .55 roll

GROUP 3

Find the total for each kind of merchandise and the totals for each department:

Dress Goods Department

1. Flannels: $4\frac{1}{4}$, $6\frac{1}{2}$, $3\frac{3}{4}$, $5\frac{1}{4}$, $8\frac{1}{2}$ yd. @ $1.80 yard
2. Taffetas: $6\frac{1}{2}$, $10\frac{3}{4}$, $4\frac{1}{4}$, $5\frac{1}{2}$, $3\frac{3}{4}$ yd. @ $.88 yard
3. Corduroys: $2\frac{3}{8}$, $4\frac{1}{2}$, $6\frac{1}{4}$, $3\frac{3}{4}$, $5\frac{1}{4}$ yd. @ $1.12 yard
4. Cotton Prints: $2\frac{1}{8}$, $3\frac{1}{4}$, $5\frac{1}{2}$, $6\frac{3}{4}$, $3\frac{1}{2}$ yd. @ $.40 yard
5. Denims: $3\frac{5}{8}$, $4\frac{1}{2}$, $7\frac{3}{4}$, $6\frac{1}{4}$, $4\frac{3}{4}$ yd. @ $.56 yard

Men's Furnishings Department

1. 18 Wool Slipover Sweaters..... @ $3.95 each
2. 32 Cotton Flannel Shirts....... @ $2.75 each
3. 16 Dress Shirts............... @ 2 for $7.80
4. 6 Tie Sets.................... @ 2 sets for $3.90
5. 24 pr. Socks.................. @ 3 pr. for $4.30

Hardware Department

1. 40 Hack Saw Blades.......... @ 2 for $ .85
2. 24 6-inch Files................ @ 6 for $2.75
3. 72 sheets Emery Cloth........ @ 6 for $ .59
4. 500 Machine Bolts............ @ 50 for $1.29
5. 20 Shelf Brackets............. @ 2 for $1.49

UNIT 14

Division of Decimals

To DIVIDE one decimal by another, move the decimal points in the dividend and divisor as many places to the right as necessary to make the divisor a whole number; divide in the usual way, annexing zeros to the dividend until the result comes out even or is carried to the required number of decimal places; and place the decimal point in the quotient directly over the decimal point in the dividend.

The rule may also be stated as follows: To divide one decimal by another, divide in the usual way and point off as many places in the quotient as those in the dividend exceed those in the divisor. It should be remembered, when using this method, that every zero annexed to the dividend is counted as another place in the dividend.

EXAMPLE. Divide 1.8448 by .32.

SOLUTION.

```
         5.765
    .32)1.84480
         1 60
         ----
           244
           224
           ---
            208
            192
            ---
             160
             160
             ---
```

Problems

GROUP 1

Divide:

1. $0.48 \div 6$
2. $0.72 \div 8$
3. $9.6 \div 8$
4. $25.8 \div 6$
5. $0.075 \div 5$
6. $0.064 \div 8$
7. $12.88 \div 7$
8. $72. \div .08$
9. $8.4 \div 0.6$
10. $12.8 \div 0.4$
11. $6.56 \div 0.8$
12. $20.16 \div 0.003$
13. $5.33\frac{1}{3} \div 3.3\frac{1}{3}$
14. $15.33\frac{1}{3} \div 33.3\frac{1}{3}$
15. $25.16\frac{2}{3} \div 0.16\frac{2}{3}$

GROUP 2

Note: When the division does not come out even, carry the answer to four decimal places.

Divide:

1. 535.65 ÷ 15.5
2. .8575 ÷ 125
3. 78.425 ÷ 6.25
4. 37.625 ÷ 5.375
5. 442.8696 ÷ 5.68
6. 103.4709 ÷ 33.54
7. 97.34 ÷ 2.96
8. 395.73 ÷ 6.35
9. 9800 ÷ 9000
10. 84 ÷ 1230
11. 29.647 ÷ 31.42
12. 567.843 ÷ $81.33\frac{1}{3}$

UNIT 15

Dividing by 10, 100, and 1000

EXAMPLE. Solve the following: (*a*) 568.4 ÷ 10; (*b*) 5.84 ÷ 10; (*c*) 65.78 ÷ 100; (*d*) 7.43 ÷ 100; (*e*) 325.6 ÷ 1000; (*f*) 21.89 ÷ 1000.

The results are found by merely moving the decimal point.

SOLUTION.

(*a*) 568.4 ÷ 10 = 56.84
(*b*) 5.84 ÷ 10 = .584
(*c*) 65.78 ÷ 100 = .6578
(*d*) 7.43 ÷ 100 = .0743
(*e*) 325.6 ÷ 1000 = .3256
(*f*) 21.89 ÷ 1000 = .02189

It follows from the above that a decimal is divided by 10 by moving the decimal point one place to the left, that it is divided by 100 by moving the decimal point two places to the left, that it is divided by 1000 by moving the decimal point three places to the left, and so forth. Note that, whenever necessary, zeros are inserted in the quotients.

Problems

GROUP 1

Divide each of the following problems by 10, by 100, and by 1000:

1. 54
2. 2.5
3. .125
4. 2.08
5. .36
6. 7.42
7. .523
8. 15.4
9. 155.6
10. .013
11. 17.52
12. 1256.2
13. 1000
14. 2.75
15. 1
16. 10
17. 8.75
18. .14
19. 28.3
20. 357.32
21. 3000
22. 150
23. 32,564
24. 180.8

GROUP 2

Find the cost of one unit at the following prices:

1. 10 for $1.75
2. 100 for $27.50
3. 1000 for $285
4. 20 for $3.40
5. 300 for $69
6. 500 for $77.50

7. 10 for \$6.00
8. 100 for \$66
9. 1000 for \$555
10. 20 for \$7.50
11. 150 for \$24 per 100
12. 500 for \$60 per 1000
13. 110 for \$50 per 100
14. 1500 for \$80 per 1000
15. 250 for \$120 per 1000

Group 3

Solve the following problems:

1. One carat weighs 3.086 grains. What is the weight of $\frac{1}{4}$ carat?

2. If a racer drives an automobile $1120\frac{1}{4}$ miles in $12\frac{1}{2}$ hours, what is his average speed per hour?

3. If 240 books sold for \$500, what is the average price per book?

4. A salesman drove 229.6 miles, using 14 gallons of gasoline. How many miles did he average per gallon?

5. If a strip of metal 135.44 inches long is cut into 16 equal parts, how long will each part be?

UNIT 16

Dividing One Complex Decimal by Another

Example. Divide $225.66\frac{2}{3}$ by $5.3\frac{1}{3}$.

Solution.

$$225.66\tfrac{2}{3} \times 3 = 677$$
$$5.3\tfrac{1}{3} \times 3 = 16$$

$$\begin{array}{r}
42\frac{5}{16}\\
16\overline{)677}\\
\underline{64}\\
37\\
\underline{32}\\
5
\end{array}$$

In dividing one complex decimal by another, change the complex decimals to simple decimals if possible or multiply both numbers by the lowest common multiple of the denominators of the common fractions.

Problems

Divide the following:

1. $84.36\frac{1}{4} \div 4.3\frac{1}{2}$
2. $128.56\frac{5}{8} \div 3.2\frac{2}{3}$
3. $375.25\frac{3}{8} \div 25.12\frac{1}{4}$
4. $88.44 \div 3.6\frac{1}{4}$
5. $482.18\frac{2}{3} \div 4.16\frac{1}{3}$
6. $68.33\frac{1}{3} \div 1.03\frac{1}{3}$
7. $34.18\frac{3}{4} \div \frac{5}{16}$
8. $57.14\frac{1}{2} \div 5\frac{3}{8}$
9. $6.4\frac{3}{4} \div 2.5\frac{1}{2}$
10. $8.6\frac{2}{3} \div .22\frac{1}{3}$

Chapter Test—Review

Write the following as decimal fractions:

1. four hundredths
2. twenty-three thousandths
3. six tenths
4. five and eight tenths
5. seven and seven thousandths
6. $\frac{1}{3}$
7. $\frac{2}{5}$
8. $\frac{5}{6}$
9. $\frac{1}{12}$
10. $\frac{1}{9}$
11. $\frac{1}{6}$
12. $\frac{7}{8}$
13. $\frac{1}{7}$
14. $\frac{3}{8}$
15. $\frac{1}{16}$

Express as decimal fractions. Carry to two decimal fractions and show the remainder, if any, as a common fraction:

16. $\frac{15}{16}$ **17.** $\frac{9}{24}$ **18.** $\frac{7}{15}$ **19.** $\frac{12}{200}$ **20.** $\frac{24}{25}$

Arrange the three numbers in each group according to size, largest to smallest:

21. .4 .44 .444
22. .01 .012 .12
23. 32.4 3.24 .324
24. .36 .3 3.3
25. .002 .004 .01
26. .705 .715 .071

Round off to the nearest tenth:

27. .06 **28.** 2.93 **29.** .74 **30.** .25 **31.** 1.66

Round off to the nearest hundredth:

32. .345 **33.** .508 **34.** 9.014 **35.** .685 **36.** 2.999

Round off to the nearest thousandth:

37. .0009 **38.** 1.0025 **39.** .0999 **40.** .7514 **41.** .3095

Add:

42. $40.16 + 108.67 + 57.047 + 80 + .006$
43. $2.8 + 9.04 + 16.009 + 28.1764$
44. $.58 + 95.4 + 1.007 + 162.3$
45. $6.7\frac{3}{8} + 22.55\frac{2}{5} + 67.03\frac{1}{3} + 18.6\frac{1}{4}$
46. $9.4\frac{5}{6} + 8.03\frac{2}{3} + .14\frac{2}{7} + 33.46\frac{1}{8}$

Subtract:

47. $.5 - .42$
48. $356 - .87$
49. $500 - 302.647$
50. $12 - 6.2$
51. \$8.00 − \$6.75
52. $.300 - .137$
53. $7.32\frac{1}{5} - 4.86\frac{1}{8}$
54. $52.67\frac{1}{2} - 43.222\frac{1}{4}$

Multiply:

55. 4.06×1.008
56. $6.24 \times .808$
57. $.009 \times .044$
58. $6.34 \times .37\frac{1}{2}$
59. $28 \times 5.62\frac{1}{2}$
60. $218 \times .14\frac{2}{7}$
61. $8.32\frac{5}{8} \times .71\frac{1}{4}$
62. $3\frac{1}{3} \times 1.26\frac{1}{6}$
63. $.4765 \times 100$

Divide and carry to two decimal places:

64. .06 ÷ 300
65. 342.8 ÷ 106
66. .004 ÷ .7
67. 1780.4 ÷ .44
68. 76.44 ÷ $4.67\frac{1}{2}$
69. $84\frac{1}{2}$ ÷ $.326\frac{1}{3}$
70. .4687 ÷ 1000
71. 307.44 ÷ .026
72. 8000 ÷ .0064
73. 30,768 ÷ 2.42
74. 6.48 ÷ .0075
75. 24.32 ÷ 1.62

Chapter 5

Percentage

UNIT 1

Meaning of Per Cent

THE WORD *per cent* means *in the hundredths,* or *hundredths.* It is indicated by the symbol %. Thus, the 40% in our problem may be expressed in the form of decimal and common fractions as follows: 40% = .40 = forty hundredths = $\frac{40}{100}$ = $\frac{4}{10}$ = $\frac{2}{5}$. Also note that *percentage* involves fractions whose denominators are 100.

Problems

Complete the following as shown by the example in the first line:

No.	*Per Cent*	*Decimal*	*Fractions with 100 as Denominator*	*Common Fractions in Lowest Terms*
1.	40%	.40	$\frac{40}{100}$	$\frac{2}{5}$
2.	$62\frac{1}{2}$%			$\frac{5}{8}$
3.	$33\frac{1}{3}$%	$.33\frac{1}{3}$		
4.	50%		$\frac{50}{100}$	
5.	$37\frac{1}{2}$%			$\frac{3}{8}$
6.	.5%	.005		
7.	.25%		$\frac{25}{10,000}$	
8.	75%			$\frac{3}{4}$
9.	$83\frac{1}{3}$%		$\frac{83\frac{1}{3}}{100}$	
10.	$12\frac{1}{2}$%	.125		
11.	20%			$\frac{1}{5}$
12.	$66\frac{2}{3}$%		$\frac{66\frac{2}{3}}{100}$	
13.	90%	.9		
14.	$14\frac{2}{7}$%			$\frac{1}{7}$
15.	$6\frac{1}{4}$%	.0625		

UNIT 2

Expressing a Decimal as a Per Cent

Example. Express the following decimals as per cents: .06; 2; .084; .0035; 3.6.

Solution.

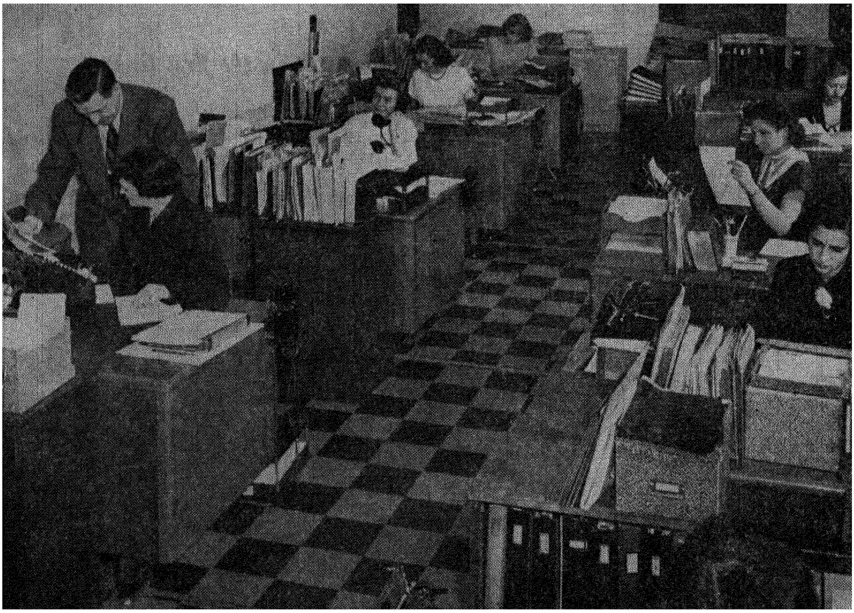
.06 = 6%; 2 = 200%; .084 = 8.4%; .0035 = .35%; 3.6 = 360%.

To change a decimal to a per cent, we actually multiply the number by 100; that is, we move the decimal point two places to the right, and affix the per cent sign.

Problems

Express as per cents:

1. .25
2. .025
3. .0025
4. 2.5
5. .0125
6. .16
7. .875
8. .45
9. 2.75
10. .004
11. .0375
12. .001
13. .01
14. .075
15. .75
16. .755
17. 7.5
18. 1.2
19. 1.45
20. .00125
21. .0625
22. 3.75
23. .0005
24. 1.15
25. .86
26. .15
27. 3.00
28. .003
29. $1.66\frac{2}{3}$
30. $.14\frac{2}{7}$



A Small Business Office. Percentage is often used in the calculations of business offices.

UNIT 3

Expressing a Per Cent as a Decimal

Example. Express the following per cents as decimals: 3%; 75%; 2.5%; 250%; $\frac{1}{2}$%.

Solution.
3% = .03; 75% = .75; 2.5% = .025; 250% = 2.5; $\frac{1}{2}$% = .5% = .005.

In changing a per cent to a decimal, it should be evident that we *divide* the number by 100, by moving the decimal point two places to the left, and drop the per cent sign.

It is best to change a common fraction to a decimal fraction before removing the per cent sign.

Problems

Write the following per cents as decimals:

1. 28%
2. 8.2%
3. 4.5%
4. 55%
5. 6%
6. 1%
7. 125%
8. 87.5%
9. 2.225%
10. 225%
11. $\frac{1}{5}$%
12. 140%
13. .25%
14. $\frac{5}{8}$%
15. $12\frac{3}{8}$%
16. $16\frac{2}{3}$%
17. 6.25%
18. 24%
19. .6%
20. 1.45%
21. .01%
22. 2.98%
23. .3%
24. .595%
25. .001%
26. 2.32%
27. .016%
28. .833%
29. 54.6%
30. .207%
31. .65%
32. .384%
33. 5.2%
34. .8%
35. 44.6%
36. .0025%
37. .09%
38. .2345%
39. $.08\frac{1}{3}$%
40. 5%

UNIT 4

Reducing a Common Fraction or Mixed Number to a Per Cent

Example. Reduce the following common fractions and mixed numbers to per cents: $\frac{1}{4}$; $1\frac{3}{8}$.

Solution. $\frac{1}{4}$ = .25 = 25%; $1\frac{3}{8}$ = 1.375 = 137.5%.

To reduce a common fraction or mixed number to a per cent, express it as a decimal, move the decimal point two places to the right, and annex the per cent symbol.

Problems

Write the following common fractions and mixed numbers as per cents:

1. $\frac{1}{2}$
2. $\frac{1}{10}$
3. $\frac{5}{6}$
4. $\frac{7}{10}$
5. $\frac{3}{8}$
6. $\frac{1}{7}$
7. $\frac{1}{12}$
8. $\frac{5}{8}$
9. $\frac{2}{5}$

10. $\frac{1}{9}$
11. $12\frac{1}{2}$
12. $1\frac{2}{3}$
13. $2\frac{3}{8}$
14. $1\frac{1}{2}$
15. $2\frac{1}{3}$
16. $2\frac{7}{8}$
17. $3\frac{3}{4}$
18. $2\frac{1}{7}$
19. $4\frac{1}{8}$
20. $3\frac{5}{6}$
21. $\frac{3}{25}$
22. $\frac{3}{200}$
23. $\frac{9}{10}$
24. $\frac{1}{400}$

UNIT 5

Finding the Per Cent of a Number When the Rate Is an Aliquot Part

EXAMPLE. On a stormy day 40% of the 250 flights scheduled at the airport in the illustration were canceled. How many were canceled?

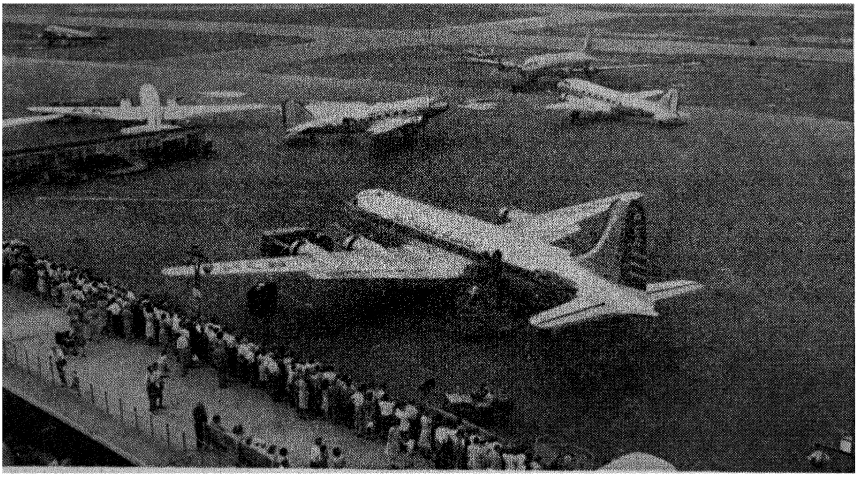
FIRST SOLUTION.

$$40\% = \frac{2}{5}$$
$$250 \times \frac{2}{5} = 100, \text{ number of flights canceled.}$$

SECOND SOLUTION.

$$40\% = .40$$
$$250 \times .40 = 100, \text{ number of flights canceled.}$$

Hence, to find a per cent of a number, express the rate per cent as a common or decimal fraction and then multiply the number by it.



Courtesy Port of New York Authority

Problems

Change the per cents in the following problems to common fractions or mixed numbers before solving:

1. $62\frac{1}{2}\%$ of 48.
2. 60% of 40.
3. $37\frac{1}{2}\%$ of 64.
4. 50% of 80.
5. $33\frac{1}{3}\%$ of 36.
6. $83\frac{1}{3}\%$ of 120.
7. 125% of 12.
8. $162\frac{1}{2}\%$ of 180.
9. 40% of 88.
10. $66\frac{2}{3}\%$ of 60.
11. $16\frac{2}{3}\%$ of 24.
12. 75% of 16.
13. $12\frac{1}{2}\%$ of 56.
14. 20% of 55.
15. $8\frac{1}{3}\%$ of 144.
16. 150% of 12.
17. $133\frac{1}{3}\%$ of 45.
18. $14\frac{2}{7}\%$ of 42.
19. 25% of 120.
20. 20% of 125.
21. 10% of 240.
22. $62\frac{1}{2}\%$ of 32.
23. $87\frac{1}{2}\%$ of 72.
24. $11\frac{1}{9}\%$ of 99.
25. $6\frac{1}{4}\%$ of 96.
26. $9\frac{1}{11}\%$ of 88.
27. 80% of 140.
28. $\frac{1}{2}\%$ of 100.
29. $\frac{3}{8}\%$ of 40.
30. $.2\%$ of 70.

UNIT 6

Finding the Per Cent of a Number When the Rate Is Not an Aliquot Part

EXAMPLE. Find $9\frac{1}{8}\%$ of \$6244, carrying the result to the nearest cent.

FIRST SOLUTION.

9% of \$6244 = \$561.96
1% of \$6244 = \$62.44
\$62.44 ÷ 8 = \$7.805, $\frac{1}{8}\%$ of \$6244.
\$561.96 + \$7.805 = \$569.765, or \$569.77, $9\frac{1}{8}\%$ of \$6244.

SECOND SOLUTION. $9\frac{1}{8}\% = .09125$

```
     6244
   .09125
   ------
    31220
   12488
   6244
 56196
 ----------
 569.76500, or $569.77
```

Problems

GROUP 1

Find the per cent of the following numbers, using one of the above methods:

1. 6% of \$250
2. $.5\%$ of \$480
3. 24% of 82
4. 200% of \$240
5. 35% of \$500
6. $2\frac{1}{2}\%$ of \$800
7. 4% of 40
8. 45% of 82
9. 9% of 600
10. 18% of 75
11. 120% of 130
12. 300% of 85
13. 1% of 655
14. 3.35% of 25
15. 47% of 84
16. 15% of 225
17. 5.4% of 32.6
18. $\frac{1}{4}\%$ of 70
19. 6.25% of \$6200
20. $5\frac{3}{4}\%$ of \$425
21. 48% of \$52
22. $.6\%$ of \$7000
23. 250% of 100
24. $\frac{3}{4}\%$ of \$17.20
25. 9% of 12
26. $.8\%$ of 62
27. 24% of 182
28. $22\frac{1}{2}\%$ of 156
29. $7\frac{1}{2}\%$ of 49
30. 115% of 55

GROUP 2

1. Four per cent of 6700 persons under four years of age died from drownings. How many died in this group?

2. James made a grade of 70% on 30 questions. How many questions did he miss?

3. John saved 15% of his salary of $28 per week. How much did he save in eight weeks?

4. On a trip of 260 miles, a man traveled 65 per cent by train and 35 per cent by bus. How many miles did he travel by train and how many by bus?

5. Henry delivered 65 papers a day. He increased the amount by 30 per cent. How many papers did he then deliver?

UNIT 7

Finding What Per Cent One Number Is of Another

Relationship Expressed as an Aliquot Part

EXAMPLE. Out of a total number of 72 airplanes, one airline has 18 new ones. Another airline operates 15 new planes out of a total of 40. Which company has the larger percentage of new machines, and how much larger?

SOLUTION.

$18 \div 72 = \frac{18}{72} = \frac{1}{4} = .25$, or 25%, new planes owned by first airline.

$15 \div 40 = \frac{3}{8} = .37\frac{1}{2}$, or $37\frac{1}{2}\%$, new planes owned by second airline.

$37\frac{1}{2}\% - 25\% = 12\frac{1}{2}\%$, excess of new planes owned by second airline over new planes owned by first airline.

PROOF.

$$25\% \text{ of } 72 = \frac{1}{4} \times 72 = 18$$
$$37\frac{1}{2}\% \text{ of } 40 = \frac{3}{8} \times 40 = 15$$

Although the first airline owns *more* new planes than the second, it has a smaller percentage of new planes than the second. Thus you see the importance of comparing similar quantities on a common basis. Percentage is that basis. From these calculations, we can state the rule in the following summary form: To find what per cent one number is of another, divide one by the other and then express the result as a per cent.

Stating it in another way, express the relationship in terms of a common fraction, convert the common fraction into a decimal, and then annex the per cent sign.

Problems

Group 1

Change to common fractions in finding the following per cents:

1. What per cent of 40 is 25?
2. What per cent of 27 is 3?
3. 49 is what per cent of 70?
4. 24 is what per cent of 48?
5. What per cent of 80 is 20?
6. What per cent of 72 is 9?
7. What per cent of 24 is 18?
8. 40 is what per cent of 60?
9. 49 is what per cent of 56?
10. 20 is what per cent of 100?
11. What per cent of 99 is 33?
12. 8 is what per cent of 56?
13. What per cent of 96 is 12?
14. 10 is what per cent of 25?
15. What per cent of 40 is 12?
16. 6 is what per cent of 72?
17. What per cent of 12 is 2?
18. 9 is what per cent of 15?
19. What per cent of 36 is 30?
20. 20 is what per cent of 25?

Group 2

1. Mary solved 35 out of 50 arithmetic problems correctly. What was her grade?

2. Ethel missed three questions in a test of 20 questions. What per cent did she have correct?

3. A bookstore sold 2200 copies of a book from an inventory of 3000 copies. What per cent did it sell?

4. A lawnmower listed at $30 was sold at a discount of $4. What was the per cent of discount?

5. A school lost 5 of its football games and won 4. What was the per cent won?

UNIT 8

Relationship Expressed Not as an Aliquot Part

VARIOUS METHODS may be used to find the percentage when the fraction resulting from dividing one number by the other is not an aliquot part of 100%.

EXAMPLE 1. 28 is what per cent of 700?

SOLUTION. 1% of 700 = 7
28 ÷ 7 = 4
28 = 4% of 700

PROOF. 700 × .04 = 28

EXAMPLE 2. $927.25 is what per cent of $4725.75? (Carry the result to the nearest hundredth per cent.)

Solution.

$$
\begin{array}{r}
.19621, \text{ or } 19.62\% \\
472575\overline{)92725.00000} \\
\underline{472575} \\
4546750 \\
\underline{4253175} \\
2935750 \\
\underline{2835450} \\
1003000 \\
\underline{945150} \\
578500
\end{array}
$$

Proof.

$$\$4725.75 \times .1962 = \$927.19215$$

$$\$927.19215 + .05785 \text{ (remainder)} = \$927.25$$

Problems

In finding the per cent in the following problems, carry the result to the nearest hundredth:

1. 2.75 is ____% of 62?
2. 68 is ____% of 174?
3. ____% of 64 is 18?
4. 8 is ____% of 18?
5. ____% of 44 is 88?
6. ____% of $6\frac{1}{4}$ is $2\frac{1}{2}$?
7. 25 is ____% of 60?
8. ____% of 5.4 is 2.8?
9. 16 is ____% of 128?
10. .12 is ____% of 26?
11. ____% of 38 is 16?
12. 32 is ____% of 12?
13. 68 is ____% of 116?
14. ____% of 30 is 8?
15. ____% of 116 is 64?
16. 1.25 is ____% of 62.72?
17. 9 is ____% of 40?
18. 26 is ____% of 14?
19. ____% of 9 is 42?
20. 16 is ____% of 328?

Percentage Used in Business

Complete the following:

ANALYSIS OF STOCKHOLDERS

FAIRMOUNT MANUFACTURING COMPANY
December 31, ____

Showing Distribution of Stock by Number of Shares Held

No. of Stockholders	*No. of Shares Each Held*	*Value of Stock per Share*	*Value of Stock*	*% of Total Value*
3	5	$68.00		
10	10	68.00		
15	100	68.00		
5	1000	68.00		
2	5000	68.00		
		Total Value of Stock $		

UNIT 9

Finding a Number When a Certain Per Cent of It Is Known

Example 1. A visitor who is standing on the observation deck at the airport shown on page 78 learns that 30 of the pilots at that field have had more than 10,000 hr. flying experience, and that these men are 20% of the total number of flyers at the field. How many pilots are there at the field?

Solution.

$$20\% \text{ of total number of pilots} = 30$$

$$20\% = \tfrac{1}{5}$$

$$30 \div \tfrac{1}{5} = 30 \times 5 = 150, \text{ total number of pilots.}$$

Notice that in this problem the per cent of the number that is known is an aliquot part of 100%. Hence the number is found by dividing the part given by the aliquot part that is equivalent to the known per cent.

In the following problem, the known per cent is not an aliquot part of 100%:

Example 2. 147 is 7% of what number?

First Solution.

$$\begin{aligned} 7\% \text{ of the number} &= 147 \\ 1\% \text{ of the number} &= 147 \div 7 = 21 \\ 100\% \text{ of the number} &= 100 \times 21 = 2100, \text{ the number.} \end{aligned}$$

Second Solution. $7\% = .07$

$$\begin{array}{r} 2100, \text{ the number.} \\ \cancel{0}7.\overline{)14700} \end{array}$$

Hence, to find a number when a certain per cent of it is given, express the per cent as a decimal, and divide the known part of the number by it.

Percentage is often used to express how much *larger* or *smaller* one number is than another. That is, we may be required to find a number which when increased or decreased by a certain per cent of itself is equal to a given number.

Problems

Group 1

Find the missing number:

1. 50 is 25% of ____.
2. $33\frac{1}{3}\%$ of ____ is 20.
3. 60 is 60% of ____.
4. 5% of ____ is 15.

5. 14 is $\frac{1}{2}\%$ of ____.
6. $\frac{2}{5}\%$ of ____ is 6.
7. 40 is 100% of ____.
8. $66\frac{2}{3}\%$ of ____ is 2400.
9. 80 is 200% of ____.
10. 4% of ____ is 24.
11. 70 is $12\frac{1}{2}\%$ of ____.
12. $16\frac{2}{3}\%$ of ____ is 450.
13. 20 is 6% of ____.
14. 50% of ____ is 100.
15. 300 is $8\frac{1}{3}\%$ of ____.
16. 20% of ____ is 80.5.
17. 25% of ____ is 80.75.
18. 765 is $2\frac{1}{2}\%$ of ____.
19. 125% of ____ is 1525.
20. 75% of ____ is $25\frac{1}{2}$.

GROUP 2

1. Mr. James received $2200 in commissions for a year. This was 20% of his total salary. What was his total yearly salary?

2. A suit is reduced $12.72, which is 12% of its original price. For how much did the suit sell?

3. There are 8 girls present in a class. This is 20 per cent of the total. How many pupils are in the class?

4. A man donated $12 to a charity. This was 4 per cent of the total amount given. How much was the total contribution?

5. A couple drove 400 miles in one day. This was 16 per cent of the total distance of the trip. How far did they travel?

UNIT 10

Finding the Per Cent of Increase or Decrease

EXAMPLE 1. A clerk's salary was increased from $20 a week to $25 a week. What was the per cent of increase?

SOLUTION. $25 − $20 = $5, amount of increase.

What % is $5 of $20?

$$\$5 \div \$20 = \tfrac{5}{20} = \tfrac{1}{4} = 25\%$$

EXAMPLE 2. A clerk's salary was reduced from $25 a week to $20 a week. What was the per cent of decrease?

SOLUTION. $25 − $20 = $5, amount of decrease.

What per cent is $5 of $25?

$$\$5 \div \$25 = \tfrac{5}{25} = \tfrac{1}{5} = 20\%$$

Note that the amount of increase or decrease is divided by the original number before the increase or decrease.

Problems

Find the per cent of increase or decrease:

1. What is the per cent of increase from 400 to 500?

2. A decrease from 300 to 200 is what per cent of decrease?

3. 420 is how many per cent more than 360?

4. An increase from $60 to $80 is an increase of what per cent?

5. A reduction of $50 from $200 is a reduction of what per cent?

6. Successive increases from $25 to $30 to $35 are increases of what per cents?

7. A toy was reduced from $5 to $3.75. What was the per cent of decrease?

8. Sales increased from $3200 to $4000 to $6000. What were the per cents of increase?

9. After the discount, a bill of $480 amounted to $420. What was the per cent of discount?

10. A city of 50,000 increased 15% in each of two succeeding years. What was the total per cent of increase for the two years?

Percentage Used in Business

Complete the following:

THE CRESCENT DEPARTMENT STORE
220 Main Street

COMPARISON OF DEPARTMENTAL SALES

Department	*Sales for June*	*Sales for July*	*Increase or Decrease*	*% of Increase or Decrease*
A	$1120.50	$ 970.75		
B	878.65	1006.80		
C	543.70	864.55		
D	1427.30	1160.42		
E	780.20	1362.45		
F	906.15	945.20		
G	328.40	416.90		
Totals				

Chapter Test—Review

Write the following decimals as per cents:

1. .75
2. .075
3. .0075
4. 1.5
5. 4.06
6. .35
7. .076
8. .6
9. .0004
10. .01
11. 2.05
12. .08⅓

Write the following per cents as decimals:

13. 24% **16.** 2% **19.** .02% **22.** $\frac{3}{8}$%
14. 6.2% **17.** 62.5% **20.** .4% **23.** 8%
15. 45% **18.** 350% **21.** .015% **24.** $1\frac{1}{2}$%

Change the following fractions or mixed numbers to per cents:

25. $\frac{1}{5}$ **28.** $3\frac{1}{3}$ **31.** $\frac{7}{10}$ **34.** $4\frac{5}{6}$
26. $2\frac{1}{9}$ **29.** $\frac{5}{200}$ **32.** $\frac{1}{16}$ **35.** $\frac{6}{25}$
27. $\frac{5}{8}$ **30.** $\frac{1}{600}$ **33.** $2\frac{1}{12}$ **36.** $\frac{7}{50}$

Complete each of the following:

37. 12% of $320 = $____.
38. 5% of ____ is 20.
39. 14 is ____% of 112.
40. $\frac{1}{3}$% of 165 = ____.
41. An increase from $18 to $24 is ____% increase.
42. 120% of 48 = ____.
43. 40 is ____% of 160.
44. A decrease from 324 to 162 is ____% decrease.
45. ____% of 84 is 252.
46. 5.4% of $680 = $____.
47. 216 is how many per cent more than 180? ____%
48. $24 is $\frac{1}{8}$% of $____.
49. .7% of $18.40 = $____.
50. 20 is ____% of 20.
51. ____% of 117 is 26.
52. 20 is 2% of ____.
53. $6\frac{1}{2}$% of 42.8 = ____.
54. $16\frac{2}{3}$% of ____ is 72.
55. 108% of $250 is $____.
56. ____% of 160 is 48.
57. 3% of ____ is 1.8.
58. An increase from 65 to 195 is an increase of ____%.
59. 150% of ____ is 60.
60. ____% of 327 is 8.5328.

Speed Drills in Fundamentals

Both speed and accuracy are important in the manipulation of numbers in business. This drill and similar drills which follow throughout the book are intended to help you retain the skills in fundamentals which you have acquired.

Always work as rapidly as possible. If you finish in less time than that allotted to you by the teacher, prove as many of the answers as you can.

Test 1

Add:

1. 681
784
639
459
293

2. 4326
3645
8109
7860
7289

3. 5065
2425
8056
2738
7084

4. $\frac{1}{4}$
$\frac{2}{3}$
$\frac{5}{12}$

5. $\frac{3}{10}$
$\frac{4}{5}$
$\frac{7}{20}$

6. $\frac{5}{16}$
$\frac{7}{32}$
$\frac{3}{8}$

7. .8 + 0.26 + .0035
8. 5.016 + 2.009 + .0708
9. 7.06 + 0.64 + .0025

Subtract:

10. 824
336

11. 4762
2583

12. 5624
1835

13. 5
$2\frac{2}{3}$

14. $\frac{13}{16}$
$\frac{2}{3}$

15. $5\frac{1}{5}$
$2\frac{7}{20}$

16. 5.84 − .626
17. .305 − .0025
18. 1.08 − .209

Multiply:

19. 674
48

20. 508
307

21. 65
19

22. $6\frac{1}{3} \times 8\frac{1}{2}$
23. $\frac{5}{9} \times 1\frac{2}{3}$

24. $\frac{1}{2} \times \frac{1}{4}$
25. 3.428 × 1.005
26. .084 × .0256
27. 18.54 × 1.05

Divide:

28. $8\overline{)2576}$
29. 4)8832
30. $65\overline{)1495}$
31. $100 \div 12\frac{1}{2}$
32. $18 \div \frac{5}{6}$
33. $\frac{1}{5} \div \frac{3}{4}$
34. .014 ÷ .0007
35. .09 ÷ .3
36. 2.7 ÷ .009

Change to improper fractions:

37. $4\frac{7}{8}$
38. $8\frac{1}{3}$
39. $14\frac{1}{4}$

Change to whole or mixed numbers:

40. $\frac{15}{8}$
41. $\frac{25}{6}$
42. $\frac{19}{2}$

Change to decimal fractions:

43. $\frac{3}{4}$
44. $\frac{5}{6}$
45. $\frac{5}{16}$

Round off to the nearest hundredth:

46. .307
47. 1.564
48. 2.599
49. 1.655
50. .006

Chapter 6

Denominate Numbers

WHEN WE MEASURE a quantity, we find how many times it contains another quantity of the same kind. This is called a *unit of measure.* For instance, if an object weighs four pounds, this means that it contains 4 of the units, each of which in this case is 1 pound. The standard units of measure are usually defined by law.

A *denominate number* is one which consists of two parts, the name of the unit and the number of units. Thus, *4 pounds* is a denominate number, while *4* is not. Examples of denominate numbers are: *5 yards, 6 acres, 2 pecks,* and *3 dozen.* The following tables should be learned thoroughly.

TABLES OF DENOMINATE NUMBERS

Linear Measure

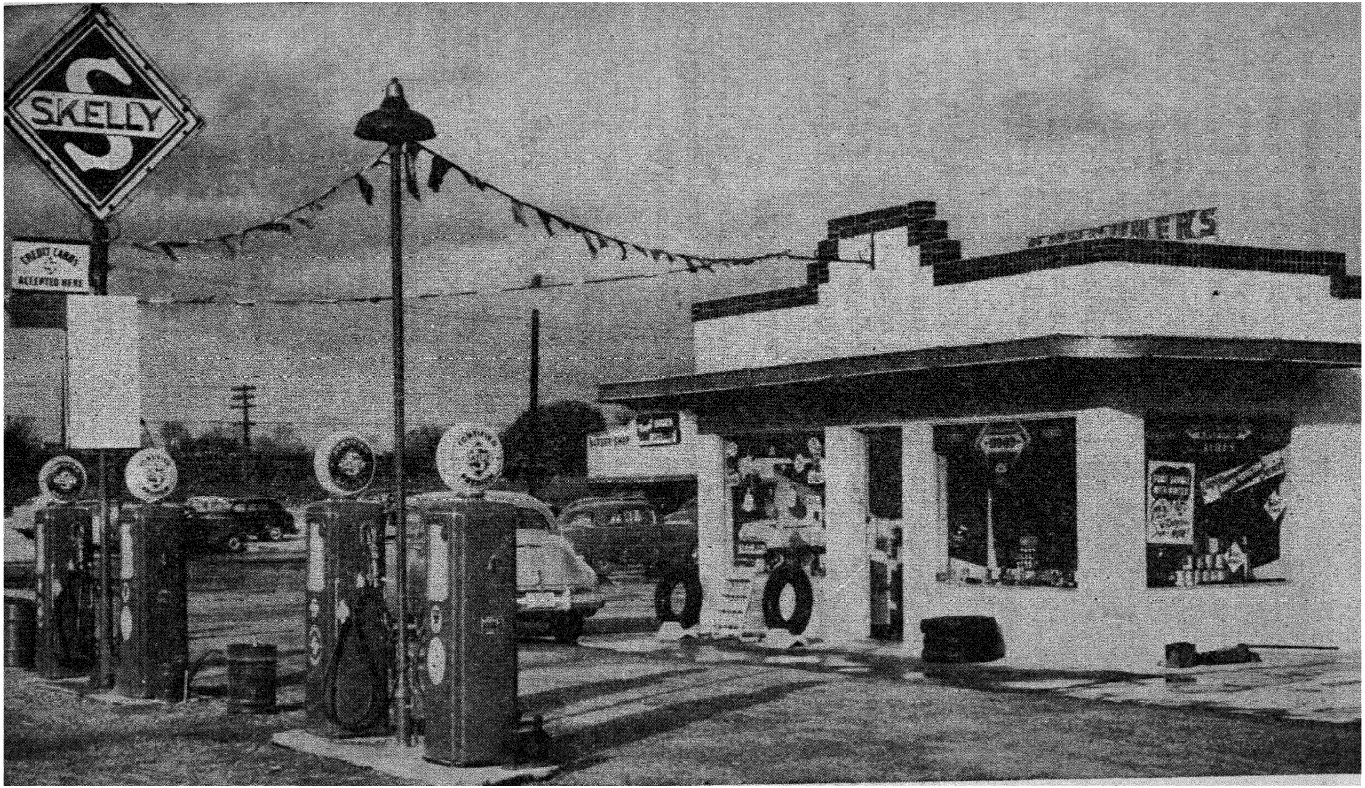
12 inches (in. *or* ″) = 1 foot (ft. *or* ′)
3 feet = 1 yard (yd.)
16½ feet = 1 rod (rd.)
5½ yards = 1 rod
5280 feet = 1 mile (mi.)
320 rods = 1 mile

Square Measure

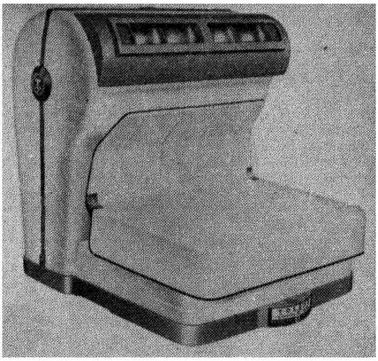
144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
272¼ square feet = 1 square rod (sq. rd.)
30¼ square yards = 1 square rod
160 square rods = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)
36 square miles = 1 township

Cubic Measure

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)



A Typical Gasoline Station. Stations like this use many kinds of measures. Gasoline is sold by the gallon, oil by the quart, grease by the pound, wiring by the foot.



Toledo Scale Co.

A Modern Food Store Scale. This machine not only weighs by ounces and pounds but automatically calculates the price.

Dry Measure

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

Liquid Measure

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)
$31\frac{1}{2}$ gallons = 1 barrel (bbl.)

Angles and Arcs

60 seconds ($''$) = 1 minute ($'$)
60 minutes = 1 degree ($^\circ$)
90 degrees = 1 right angle
360 degrees = 1 circle

Counting

12 units = 1 dozen (doz.)
12 dozen = 1 gross (gr.)
144 units = 1 gross

Weight

16 ounces (oz.) = 1 pound (lb.)
100 pounds = 1 hundredweight (cwt.)
2000 pounds = 1 ton (T.)

UNIT 1

Changing Denominate Numbers to Different Units

THE FORM of denominate numbers must often be changed in adding, subtracting, multiplying, and dividing. The following exercises will help you to make these changes rapidly and accurately.

EXAMPLE 1. Change 3 bu., 2 pk., 1 qt., to quarts.

SOLUTION.

$$\begin{array}{r} 3\text{ bu.} = 3 \times 4\text{ pk.} = 12\text{ pk.} \\ \underline{+2}\text{ pk.} \\ 14\text{ pk.} \end{array}$$

$$\begin{array}{r} 14\text{ pk.} = 14 \times 8\text{ qt.} = 112\text{ qt.} \\ \underline{+1}\text{ qt.} \\ 113\text{ qt.} \end{array}$$

EXAMPLE 2. Change 127 in. to feet and inches.

SOLUTION. 127 in. ÷ 12 = 10 ft. and 7 in.

Problems

Group 1

Change to the denominations indicated in the following exercises:

Linear Measure

1. 1 yd. = ____ in.
2. 5 rd. = ____ yd.
3. $\frac{1}{2}$ mi. = ____ rd.
4. $\frac{1}{4}$ yd. = ____ in.
5. 150 in. = ____ ft. ____ in.
6. 2 rd. = ____ ft.
7. 4 yd. 10 in. = ____ in.
8. $2\frac{1}{2}$ mi. = ____ ft.
9. 5 rd. 3 yd. = ____ ft.
10. 27 yd. = ____ ft.
11. 500 ft. = ____ yd.
12. 6 yd. 8 ft. = ____ ft.
13. 24 rd. = ____ in.
14. $20\frac{1}{2}$ ft. = ____ in.
15. 32 pk. = ____ bu.
16. 1280 rd. = ____ mi.
17. 165 ft. = ____ rd.
18. 42,240 ft. = ____ mi.
19. 66 yd. = ____ rd.
20. 300 ft. = ____ rd.

Square Measure

1. 320 sq. rd. = ____ A.
2. 81 sq. ft. = ____ sq. yd.
3. 432 sq. in. = ____ sq. ft.
4. 6 A. = ____ sq. rd.
5. 2 sq. mi. = ____ sq. rd.
6. 6 sq. ft. = ____ sq. in.
7. 4 sq. yd. = ____ sq. in.
8. 1 township = ____ A.
9. 2000 sq. in. = ____ sq. yd. ____ sq. ft.
10. 500 sq. rd. = ____ sq. ft. ____ sq. in.

Cubic Measure

1. 5184 cu. in. = ____ cu. ft.
2. 216 cu. ft. = ____ cu. yd.
3. 13,000 cu. in. = ____ cu. ft. ____ cu. in.
4. 8 cu. ft. = ____ cu. in.
5. $2\frac{2}{3}$ cu. yd. = ____ cu. ft.
6. 5 cu. yd. = ____ cu. in.

Dry Measure

1. 17 pt. = ____ qt.
2. 36 qt. = ____ pk.
3. 32 pk. = ____ bu.
4. 120 qt. = ____ bu.
5. $16\frac{1}{2}$ bu. = ____ qt.
6. 27 qt. = ____ pt.
7. 12 pk. = ____ pt.
8. 6 bu. = ____ pt.
9. 12 bu. = ____ pk.
10. 4 bu. 6 qt. = ____ qt.

Liquid Measure

1. 16 gi. = ____ pt.
2. 32 pt. = ____ qt.
3. 64 qt. = ____ gal.
4. 181 gal. = ____ bbl.
5. 20 gal. = ____ pt.
6. 6 pt. = ____ gi.
7. $18\frac{1}{2}$ qt. = ____ pt.
8. 24 gal. = ____ pt.
9. 2 bbl. = ____ qt.
10. 6 gal. 4 qt. = ____ pt.

ANGLES AND ARCS

1. 540″ = ____′
2. 360′ = ____°
3. 1080′ = ____circle
4. 75° 40′ = ____′
5. 4 right angles = ____°
6. 60° 20″ = ____″

COUNTING

1. 144 units = ____ doz.
2. 72 doz. = ____ gr.
3. 432 units = ____ gr.
4. 8 doz. = ____ units
5. 5 gr. = ____ doz.
6. 10 gr. = ____ units.

WEIGHT

1. 80 oz. = ____ lb.
2. 10,000 lb. = ____ cwt.
3. 20,000 lbs. = ____ T.
4. 10 lb. = ____ oz.
5. 250 cwt. = ____ lb.
6. 12 T. = ____ lb.

GROUP 2

Without referring to the tables, complete the following:

1. 165 in. = ____ ft. ____ in.
2. 1250 sq. rd. = ____ A. ____ sq. rd.
3. 9 yd. 1 ft. = ____ ft.
4. 8 lb. = ____ oz.
5. 64 pk. = ____ bu.
6. 5 cu. ft. 228 cu. in. = ____ cu. in.
7. 300 pt. = ____ gal.
8. 45° = ____′
9. 5 gr. = ____ doz.
10. 12 sq. ft. = ____ sq. in.
11. 14 lbs. 10 oz. = ____ oz.
12. 86 pk. = ____ bu. ____ pk.
13. 8 gal. = ____ pt.
14. 63 cu. ft. = ____ cu. yd.
15. 744 units = ____ gr. ____ doz.
16. 6 sq. rd. = ____ sq. ft.
17. 28,040 ft. = ____ mi.
18. 8 A. = ____ sq. ft.
19. 6 bbl. = ____ qt.
20. 24 rds. = ____ yd.

UNIT 2

Addition of Denominate Numbers

EXAMPLE 1. Add 8 ft. 5 in. and 4 ft. 6 in.

SOLUTION.

8 ft. 5 in.
4 ft. 6 in.
12 ft. 11 in.

EXAMPLE 2. Add 6 bu. 6 pk. and 5 bu. 8 pk.

SOLUTION.

6 bu. 6 pk.
5 bu. 8 pk.
11 bu. 14 pk.
or 14 bu. 2 pk. 14 pk. = 3 bu. 2 pk.

Problems

GROUP 1

Add and reduce each sum to its simplest form:

1. 4 doz. 9 units
5 doz. 8 units

2. 6 T. 1800 lb.
4 T. 2200 lb.

3. 5 yd. 28 in.
6 yd. 42 in.

4. 9 sq. ft. 84 sq. in.
6 sq. ft. 124 sq. in.

5. 6 sq. ft. 670 sq. in.
4 sq. ft. 180 sq. in.

6. 4 bu. 6 qt.
5 bu. 8 qt.

7. 2 gal. 6 qt.
5 gal. 4 qt.

8. 20° 30′
50° 40′

9. 6 rd. 12 ft.
5 rd. 8 ft.

10. 5A. 120 sq. rd.
4A. 60 sq. rd.

11. 12 gal. 4 pt.
3 gal. 6 pt.

12. 2 mi. 160 rods
5 mi. 180 rods

GROUP 2

1. Mrs. Roberts bought 4 pieces of dress material of the following lengths: 3 yd. 8 in., 5 yd. 2 in., 2 yd. 9 in., and 4 yd. 10 in. How many yards of material did she buy?

2. Mr. Jones delivered 3 loads of coal weighing as follows: 2 T. 1200 lbs., 3 T. 800 lbs., and 3 T. 600 lbs. What was the total weight of the three loads?

3. A table top is 3 ft. 6 in. wide and 5 ft. 4 in. long. What is its perimeter?

4. Three jars held the following amounts: 1 gal. 2 qt., 2 gal. 3 pt., and 5 gal. 1 qt. How much did the three jars together hold?

5. Three fields contain the following numbers of square rods: 240, 400, and 120. How many acres are there in the three fields?

UNIT 3

Subtraction of Denominate Numbers

EXAMPLE 1. Subtract 4 lb. 6 oz. from 8 lb. 10 oz.

SOLUTION.
8 lb. 10 oz.
4 lb. 6 oz.
4 lb. 4 oz.

EXAMPLE 2. Subtract 5 bu. 3 pk. from 10 bu.

SOLUTION.
10 bu. = 9 bu. 4 pk.
5 bu. 3 pk. = 5 bu. 3 pk.
4 bu. 1 pk.

Problems

GROUP 1

Subtract the following:

1. 60°
40° 36′

2. 5 gal. 3 pt.
2 gal. 2 pt.

3. 4 bu. 6 qt.
3 bu. 8 qt.

4. 3 cu. yd. 6 cu. ft.
1 cu. yd. 12 cu. ft.

5. 6 sq. ft. 70 sq. in.
2 sq. ft. 80 sq. in.

6. 12 rd. 10 ft.
6 rd. 14 ft.

7. 5 T.
3 T. 1200 lb.

8. 3 doz. 8 units
1 doz. 10 units

9. 10 yd. 22 in.
4 yd. 30 in.

10. 6 mi.
4 mi. 2200 ft.

11. 6 qt.
3 qt. 1 pt.

12. 6 gr. 8 doz.
2 gr. 9 doz.

GROUP 2

1. A truck when loaded with coal weighs 5 T. 450 lb. The empty truck weighs 1 T. 650 lb. How much does the coal weigh?

2. One boy is 6 ft. 3 in. high and another boy is 5 ft. 8 in. Find the difference in their heights.

3. One box contains 2 gr. 3 doz. pencils and another box contains 1 gr. 6 doz. How many more pencils does the first box contain than the second?

4. One lot measures 60 sq. rds. and an adjoining lot measures 64 sq. rds. How many more square feet are there in the second lot?

5. A grocer has 6 bu. 2 pk. of potatoes. He sells 3 bu. 3 pk. How many bushels does he have left?

UNIT 4

Multiplication of Denominate Numbers

EXAMPLE 1. Multiply 5 ft. 3 in. by 3.

SOLUTION.

$$\begin{array}{r} 5\text{ ft. }3\text{ in.} \\ 3 \\ \hline 15\text{ ft. }9\text{ in.} \end{array}$$

EXAMPLE 2. Multiply 4 bu. 3 pk. by 5.

SOLUTION.

$$\begin{array}{r} 4\text{ bu. }3\text{ pk.} \\ 5 \\ \hline 20\text{ bu. }15\text{ pk.} \end{array} \qquad 15\text{ pk.} = 3\text{ bu. }3\text{ pk.}$$

Answer: 23 bu. 3 pk.

EXAMPLE 3. Multiply 12 lb. 8 oz. by $8\frac{1}{2}$.

SOLUTION. 12 lb. 8 oz. = $12\frac{1}{2}$ lb.

$12\frac{1}{2}$ lb. × $8\frac{1}{2}$ = $\frac{25}{2}$ lb. × $\frac{17}{2}$ = $106\frac{1}{4}$ lb.

Problems

GROUP 1

Multiply:

1. 12 ft. 4 in. 6	**2.** 80 sq. rd. 6 sq. ft. 2	**3.** 12 cu. ft. 120 cu. in. 20
4. 8 pk. 1 pt. 12	**5.** 6 gal. 3 qt. 4	**6.** 22° 15′ 8
7. 6 doz. 10 units 9	**8.** 2 T. 350 lb. 12	**9.** 6 ft. 6 in. $8\frac{1}{2}$
10. 8 lb. 10 oz. $4\frac{3}{4}$	**11.** 16 ft. × 8 ft.	**12.** 3 ft. × 5 ft. × 8 ft.

GROUP 2

1. A boy weighs 82 lb. 4 oz. His father weighs twice as much. How much does the father weigh?

2. One box holds 4 pk. 2 qt. of apples. How much will 12 boxes of the same size hold?

3. A family buys 3 qt. of milk a day. How many gallons of milk will it buy in a year?

4. A boy walks 2 miles each day to and from school. How many feet will he walk in 20 days?

5. A woman buys 6 pieces of meat of an average weight of 4 lb. 6 oz. How many pounds of meat did she buy?

UNIT 5

Division of Denominate Numbers

EXAMPLE 1. Divide 6 yd. 2 ft. by 2.

SOLUTION.

$$\begin{array}{r} \text{3 yd. 1 ft.} \\ 2\overline{)\text{6 yd. 2 ft.}} \end{array}$$

EXAMPLE 2. Divide 15 lb. 4 oz. by 4.

SOLUTION.

$$\begin{array}{rlr} & \text{3 lb.} & \text{13 oz.} \\ 4\big) & \overline{\text{15 lb.}} & \overline{\text{4 oz.}} \\ & \underline{12} & \\ & \text{3 lb.} = & \underline{48}\text{ oz.} \\ & & \text{52 oz.} \end{array}$$

Example 3. Divide 9 qt. by 1 qt. 1 pt.

Solution. $9 \text{ qt.} \div 1\frac{1}{2} \text{ qt.} = 9 \times \frac{2}{3} = 6$

Problems

Group 1

Divide the following:

1. $2\overline{)8 \text{ pk. } 4 \text{ qt.}}$
2. $5\overline{)15 \text{ ft. } 10 \text{ in.}}$
3. $4\overline{)20 \text{ sq. ft. } 48 \text{ sq. in.}}$
4. $2\overline{)3 \text{ cu. ft. } 150 \text{ cu. in.}}$
5. $3\overline{)5 \text{ gal. } 3 \text{ qt.}}$
6. $6\overline{)8 \text{ doz. } 8 \text{ units}}$
7. $10\overline{)22 \text{ lb. } 12 \text{ oz.}}$
8. $7\overline{)12 \text{ A. } 40 \text{ sq. rd.}}$
9. $2\frac{1}{4}\overline{)12 \text{ ft.}}$
10. $1 \text{ bu. } 2 \text{ pk.}\overline{)420 \text{ qt.}}$
11. $2 \text{ lb. } 3 \text{ oz.}\overline{)14 \text{ lb.}}$
12. $12\frac{1}{2}\overline{)640 \text{ lb.}}$

Group 2

1. A board 12 ft. 6 in. long is divided into three equal parts. How long is each part?

2. A coal dealer has 6 T. 1250 lb. of coal to divide equally among four customers. How much does each customer receive?

3. A field of 360 sq. rd. is to be divided into four equal parts. How many square feet are in each part?

4. One and one-half gross of pencils are to be distributed to a class of 36 pupils. How many pencils will each pupil receive?

5. A package of cheese weighing 4 lb. 10 oz. is to be divided equally among three persons. How much cheese will each receive?

Chapter Test—Review

Change the following measures to the units indicated:

1. 48 gal. = ____ qt.
2. 6 bu. = ____ qt.
3. 27 yd. 2 ft. = ____ ft.
4. 14 lb. = ____ oz.
5. 6 cu. ft. 24 cu. in. = ____ cu. in.
6. 24 gal. = ____ pt.
7. 60 sq. ft. = ____ sq. in.
8. 864 units = ____ gr.
9. 110 yd. = ____ rd.
10. 4 A. = ____ sq. ft.
11. 8 lb. 6 oz. = ____ oz.
12. 64 pt. = ____ gal.
13. 22 cu. yd. = ____ cu. ft.
14. 114 pk. = ____ bu.
15. 8500 lb. = ____ T. ____ lb.
16. $\frac{1}{2}$ sq. mi. = ____ A.
17. $\frac{3}{4}$ lb. = ____ oz.
18. 8 rd. 2 ft. = ____ in.
19. 27 in. = ____ yd.
20. 18 cu. ft. = ____ cu. yd.

Add:

21. 2 sq. ft. 220 sq. in.
4 sq. ft. 40 sq. in.

22. 5 T. 1400 lb.
6 T. 1800 lb.

Subtract:

23. 8 yd.
3 yd. 9 in.

24. 4 gr. 6 doz.
2 gr. 8 doz.

Add:

25. $\begin{array}{r} \text{6 gal. 8 pt.} \\ \text{3 gal. 4 pt.} \\ \hline \end{array}$

26. $\begin{array}{r} \text{8 bu. 4 qt.} \\ \text{12 bu. 10 qt.} \\ \hline \end{array}$

27. $\begin{array}{r} \text{5 mi. 1180 ft.} \\ \text{3 mi. 2260 ft.} \\ \hline \end{array}$

Subtract:

28. $\begin{array}{r} \text{4 cu. yd. 8 cu. ft.} \\ \text{2 cu. yd. 12 cu. ft.} \\ \hline \end{array}$

29. $\begin{array}{r} \text{5 doz. 9 units} \\ \text{4 doz. 11 units} \\ \hline \end{array}$

30. $\begin{array}{l} \text{April 5, 1952} \\ \text{June 20, 1924} \\ \hline \end{array}$

Multiply:

31. $\begin{array}{r} \text{6 pk. 4 qt.} \\ 8 \\ \hline \end{array}$

32. $\begin{array}{r} 18^\circ\ 40' \\ 6 \\ \hline \end{array}$

33. $\begin{array}{r} \text{6 lb. 8 oz.} \\ 4\frac{1}{2} \\ \hline \end{array}$

34. $\begin{array}{r} \text{3 sq. ft. 42 sq. in.} \\ 6 \\ \hline \end{array}$

35. $\begin{array}{r} \text{6 gal. 4 qt.} \\ 2\frac{3}{4} \\ \hline \end{array}$

Divide:

36. $6\overline{)\text{8 lb. 10 oz.}}$

37. $3\overline{)\text{4A. 20 sq. rd.}}$

38. $2\frac{1}{2}\overline{)\text{640 qt.}}$

39. $4\overline{)\text{6 gr. 8 units}}$

40. $\text{1 bu. 3 pk.}\overline{)\text{64 pk.}}$

41. At the lumber yard George bought three boards of the following lengths: 12 ft. 6 in., 14 ft. 8 in., 10 ft. 10 in. What was the total length of the three boards?

42. A 3 ft. 8 in. hole is dug for an 8 ft. post. How much of the post is to be above the ground?

43. Henry delivered five parcels, each weighing 2 lb. 10 oz. What was the total weight of the five parcels?

44. A field containing 80 A. 60 sq. rd. was divided into three parts. How many acres were in each part?

45. A full tank contains 1200 barrels of water. How many gallons does it hold?

Speed Drills in Fundamentals

Test 2

Add:

1. 990 530 415 467	**2.** 1732 1124 1528 7912 7213	**3.** 2716 9521 5839 2179 6804	**4.** $5\frac{2}{3}$ $1\frac{3}{4}$ $6\frac{1}{2}$	**5.** $2\frac{1}{2}$ $4\frac{5}{8}$ $1\frac{5}{16}$	**6.** $\frac{7}{24}$ $\frac{7}{8}$ $\frac{2}{3}$

7. 0.27 + 24.24 + 0.68 + 5.02

8. 8.07 + .006 + 2.3 + .1254

9. .8 + 1.045 + 2 + 6.75

Subtract:

10. 3762 2535	**11.** 4646 1576	**12.** 8867 3528	**13.** $\frac{3}{4}$ $\frac{5}{12}$	**14.** $2\frac{3}{5}$ $1\frac{7}{10}$
15. $\frac{3}{8}$ $\frac{3}{16}$	**16.** 6.000 3.254	**17.** .01256 .00367	**18.** 10.00 .105	

Multiply:

19. 2567 87	**20.** 4732 94	**21.** 5713 765	**22.** $\frac{2}{3} \times \frac{3}{8}$

23. $1\frac{4}{5} \times 30$

24. $2\frac{5}{12} \times 5\frac{3}{8}$

25. 5.65 × .08

26. 7.208 × .23

27. 14.3 × .044

Divide:

28. $9\overline{)8762}$

29. $32\overline{)7496}$

30. $38\overline{)6745}$

31. $6\frac{1}{3} \div 2\frac{1}{4}$

32. $3\frac{1}{6} \div 1\frac{1}{3}$

33. $5\frac{3}{4} \div 2$

34. $.06\overline{)40.12}$

35. $300\overline{).9}$

36. $.05\overline{)2.5625}$

Change to per cents:

37. .625

38. 1.45

Change to decimals:

39. $\frac{1}{2}\%$

40. 36%

Change to per cents:

41. $\frac{1}{9}$

42. $\frac{5}{16}$

43. $\frac{25}{200}$

44. $\frac{1}{8}$

Complete:

45. 20% of 400 = ____.

46. 50 is ____% of 250.

47. 8% of ____ is 40.

48. $\frac{1}{3}\%$ of 300 = ____.

49. An increase from 20 to 25 is ____% increase.

50. A decrease from 25 to 20 is ____% decrease.

Chapter 7
Ratio and Proportion

UNIT 1

Ratio

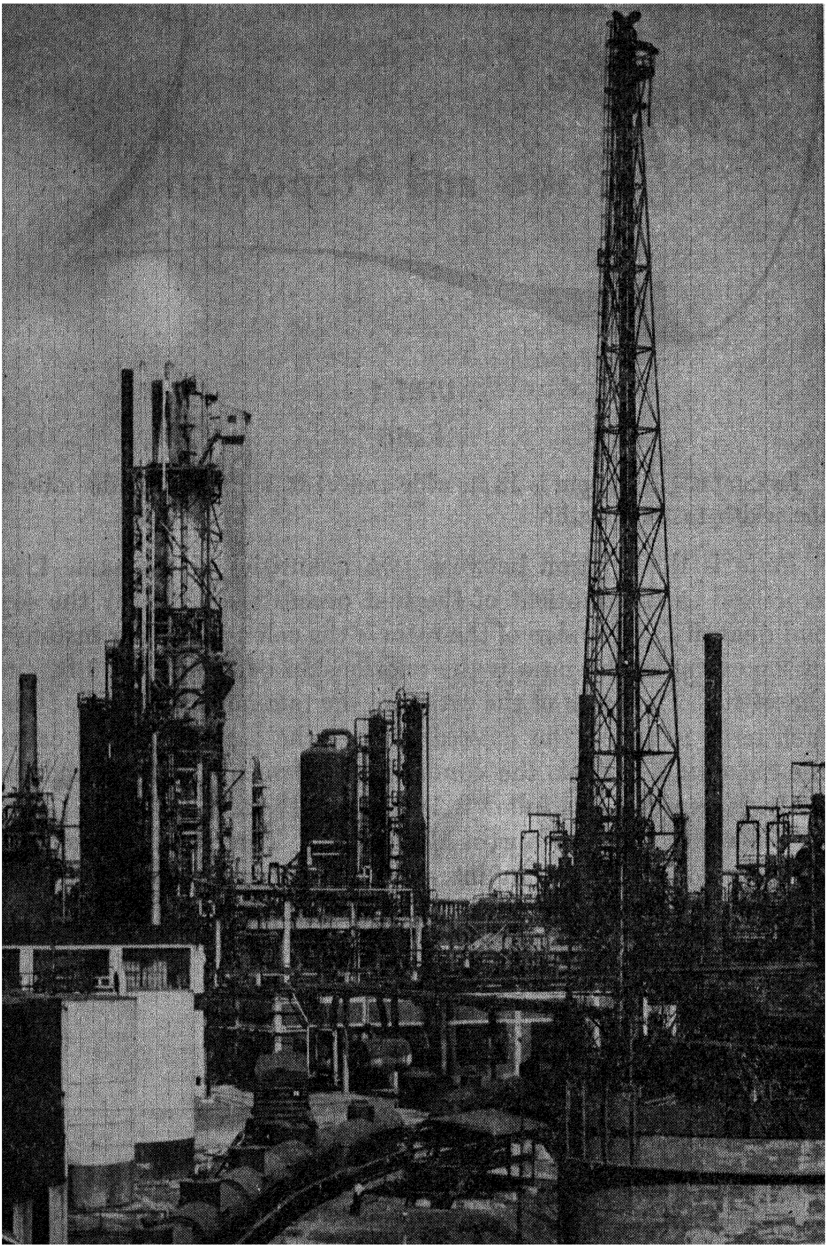
EXAMPLE. If a room is 18 ft. wide and 24 ft. long, what is the ratio of the width to the length?

Ratio is the relation between two quantities of the same kind expressed as the quotient of the first quantity divided by the second quantity. The sign of the ratio is the colon (:). For instance, in the example, the ratio is the relationship between the 18 ft. and the 24 ft. The *terms* of the ratio are the numbers compared. The first term is called the *antecedent*, and the second term is called the *consequent*. Thus, the comparison between the 18 ft. and the 24 ft. is expressed as follows: 18 : 24, or $\frac{18}{24}$, or 3 : 4, or $\frac{3}{4}$. That is, the width is three-fourths the length. Therefore, a ratio may be a fraction, such as $\frac{3}{4}$; an integer, such as 4 or $\frac{4}{1}$; or a mixed number, such as $1\frac{3}{4}$ or $\frac{1\frac{3}{4}}{1}$. The fraction $\frac{9}{12}$ may be reduced to $\frac{3}{4}$. 9 : 12 is the same as 3 : 4.

Problems

Supply the missing numbers:

1. The ratio of 3 to 12 is ____ to 4.
2. The ratio of 16 to 4 is ____ to 1.
3. The ratio of 10 to 12 is ____ to 6.
4. The ratio of 15 to 20 is ____ to 4.
5. The ratio of 10 to 20 is ____ to 100.
6. The ratio of 30 to 15 is 2 to ____.
7. The ratio of 24 to 8 is 3 to ____.
8. The ratio of 16 to 24 is 2 to ____.
9. The ratio of 7 to 21 is 1 to ____.
10. The ratio of 3 to 50 is 30 to ____.



Courtesy Standard Oil Company

Plant for Making Gasoline and By-Products. Here is a good study in proportion. Notice the size of the man standing by the oil cars.

Ratios Are Comparisons

Any two things may be compared if they are the same kind. You may compare two distances, two amounts of money, or two weights. You cannot compare, for example, three feet with three pounds, or three feet with three inches. In the latter case, you may change the feet to inches. The ratio then is 36 inches to 3 inches, which may be written $\frac{36}{3}$ or $\frac{12}{1}$ or 12 : 1.

Problems

Complete the following, being careful to express the quantities in the same units:

1. The ratio of 8 oz. to 1 lb. is ____ to ____.
2. The ratio of 50¢ to $2 is ____ to ____.
3. The ratio of 1 gal. to 2 qt. is ____ to ____.
4. The ratio of 4 pk. to 2 pt. is ____ to ____.
5. The ratio of 3 ft. to 4 rd. is ____ to ____.
6. The ratio of 2 doz. to 6 units is ____ to ____.
7. The ratio of 1 ft. to 1 rd. is ____ to ____.
8. The ratio of $2.25 to $5 is ____ to ____.
9. The ratio of 20 min. to 3 hr. is ____ to ____.
10. The ratio of 1½ qt. to 2½ gal. is ____ to ____.

UNIT 2

Proportion

EXAMPLE. If five men earn $17.50 a day, how much do ten men earn at the same rate?

Proportion is an equality of ratios. Letting x stand for the unknown—that is, the amount earned by ten men—we can express the proportion in the example as follows:

$$\underbrace{5 : \underbrace{10 : : \$17.50}_{\text{means}} : x}_{\text{extremes}}$$

As indicated above, the first and fourth terms of a proportion are called the *extremes*, and the second and third terms are called the *means*.

Problems involving proportion can be solved by the use of one of the following principles:

1. The product of the extremes equals the product of the means.
2. The product of the means divided by one extreme equals the other extreme.

3. The product of the extremes divided by one mean equals the other mean.

Solution. *By first principle.*

$$5 \times x = 10 \times \$17.50$$
$$5x = \$175$$
$$x = \$35, \text{ amount earned by ten men.}$$

By second principle.

$$x = \frac{10 \times \$17.50}{5} = \$35, \text{ amount earned by ten men.}$$

If the unknown in this problem had been a mean instead of an extreme, we should have used the third principle rather than the second.

Proof. *By the "unitary analysis method."*

$\$17.50 \div 5 = \$3.50$, amount earned by one man.
$\$3.50 \times 10 = \$35$, amount earned by ten men.

Partitive Proportion

Example. Brown, Smith, and Jones, who are partners, agree that any profits accruing from their business are to be divided into six equal parts distributed as follows: Brown, 3 parts; Smith, 1 part; and Jones, 2 parts. (That is, the profits are shared in the ratio of 3 : 1 : 2.) If the profits for the year amount to \$7200, how much should each partner receive?

Solution. $\$7200 \div 6 = \$1200$, amount of each part.
$\$1200 \times 3 = \$3600$, Brown's share.
$\$1200 \times 1 = \$1200$, Smith's share.
$\$1200 \times 2 = \$2400$, Jones's share.

Proof. $\$3600 + \$1200 + \$2400 = \$7200$, total profits.

The principle of partitive proportion can be applied to almost any situation. However, the student must remember that in partitive proportion it is necessary to reduce the terms to *like* quantities, since *only similar fractions can be compared.* Similar fractions—that is, fractions with the same denominator—are in proportion to their numerators. In the foregoing problem, the partners shared profits in the ratio of 3 : 1 : 2, which is the equivalent of $\frac{3}{6}$, $\frac{1}{6}$, and $\frac{2}{6}$ of the profits.

Example. Three men received \$38 for shingling a roof. *A* worked 1 da.; *B* worked $\frac{1}{3}$ da.; and *C* worked $\frac{1}{4}$ da. How much should each man receive?

SOLUTION. $1 = \frac{12}{12};\ \frac{1}{3} = \frac{4}{12};\ \frac{1}{4} = \frac{3}{12}$

$12 + 4 + 3 = 19$, total number of parts of days worked.

$\$38 \div 19 = \$2$, amount paid for each part.

$12 \times \$2 = \$24$, *A*'s share.

$4 \times \$2 = \$8$, *B*'s share.

$3 \times \$2 = \$6$, *C*'s share.

PROOF.

$\$24 + \$8 + \$6 = \$38$, total amount received for job.

Problems

GROUP 1

1. A room is 48 ft. long and 12 ft. wide. What is the ratio of the length to the width?

2. What is the ratio of 2 qt. to 1 pk.?

3. What is the ratio of 1 pt. to 1 gal.?

4. What is the ratio of the weights of two bundles weighing 2 oz. and $1\frac{1}{2}$ lb., respectively?

5. What is the ratio of 25¢ to $2.25?

6. If 2 men can do a piece of work in 8 da., how long will it take 4 men to do the work?

7. The total wages of 8 men are $35 a day. What are the wages of 24 men at the same rate?

8. If 7 pencils cost 15¢, what will 28 cost?

9. Divide the number 30 into parts proportional to 1 and 2.

10. At 84¢ a pound, what will 6 oz. of butter cost?

11. *A*, *B*, and *C* earned a total of $180 in a week. If their shares were in proportion to 3, 4, and 5, how much did each receive?

12. Find the missing term in the following proportion: 12 : 5 : : 60 :?.

13. State which are the means and which are the extremes in the following proportion: 5 : 6 : : 70 : 84.

14. State whether or not the following is a true proportion and explain your answer: 14 : 7 : : 98 : 56.

15. Change the proportion in Problem 14 to a true proportion.

GROUP 2

1. If 6 men are required to do a job in 20 da., how many men will be required to do the work in 8 da.?

2. A piece of roast beef weighing 5 lb. 8 oz. costs $4.95. How much can be bought for $9 at the same price per pound?

3. Divide $2750 into parts proportional to 2, 3, and 5.

4. In 32 da. 64 men can complete a section of road 6 mi. long. How many men, working the same number of days, would be required to complete a road 27 mi. long?

5. *A*, *B*, and *C* are partners and share profits in proportion to their capital investments. Their capital accounts are as follows: *A*, $12,500; *B*, $17,000; *C*, $6500. How would you distribute a profit of $1800 among the partners?

6. Stratford and Kelly rented a truck for $37.50. Stratford used it 10 hr. per day for 18 da., and Kelly used it 7 hr. per day for 10 da. How much of the rental fee should each pay if the rental is to be divided in proportion to the time the truck was used?

7. If 260 A. of land produces 35 bu. of grain per acre, how many acres will be necessary to produce 29,120 bu.?

8. If it takes 36 men 132 da. to build a boat, how many additional men are needed to construct the boat in 77 da.?

9. Elting, Fulton, and Gorr formed a partnership with a cash investment of $48,000. How much did each partner invest if the capital was to be in the ratio of 3, 4, and 5?

10. What was each partner's share of the profits in Problem 9 if at the end of the year the partnership net worth was $60,500 and profits were to be divided in proportion to investments?

Chapter Test—Review

1. The ratio of 28 to 4 is the same as ____ to 1.
2. The ratio of 5 to 6 is the same as 25 to ____.
3. The ratio of 10 to 40 is the same as 50 to ____.
4. The ratio of 4 to 14 is the same as ____ to 56.
5. The ratio of $3\frac{1}{3}$ to 10 is the same as ____ to 30.

Express these ratios in their simplest forms:

6. The ratio of 75¢ to $30 is ____ : ____.
7. The ratio of 10 minutes to two hours is ____ : ____.
8. The ratio of 1 pint to 1 gallon is ____ : ____.
9. The ratio of 1 inch to 2 yards is ____ : ____.
10. The ratio of 1 quart to 1 peck is ____ : ____.

Complete the following proportions:

11. 12 : 5 = 60 : ?
12. 16 : ? = 4 : 24
13. ? : 42 = 7 : 84
14. 65 : 13 = ? : 15

Change the following to true proportions:

15. 14 : 7 = 98 : 56
16. 3 : 18 = 28 : 78
17. 8 : 74 = 9 : 108
18. 2016 : 112 = 290 : 16

19. Three workers earned a total of $240. If their shares were in the ratio 3 : 4 : 5, how much did each receive?

20. If three men can do a piece of work in six days, how long will it take eight men to do the work?

21. James and Stewart are partners, having invested $10,000 and $15,000, respectively. Find each partner's share of a $3000 profit if it is divided in proportion to capital invested.

22. If five cans of corn can be bought for 90¢, how many cans can be bought for $2.16?

23. A 100-foot tree casts a 40-foot shadow. How long a shadow will a 60-foot tree cast at the same time of day?

24. Linda is 5′2″ tall and casts a shadow 7′ long. At the same time a building casts a shadow 20′ long. How high is the building?

25. James and Harry had $128 divided between them. James was to receive $\frac{3}{8}$ and Harry $\frac{5}{8}$. How much did each receive?

Speed Drills in Fundamentals

Test 3

Add:

1. 444
402
858
779
623

2. 4886
2968
5037
7766
8475

3. $7\frac{3}{5}$
$10\frac{2}{3}$
$4\frac{3}{10}$

4. $8\frac{1}{3}$
$10\frac{5}{8}$
$4\frac{5}{12}$

5. .056 + 4.009 + 2.548 + 1.001

6. 20.006 + 5.279 + 0.405 + .0625

7. 4 lb. 10 oz.
3 lb. 8 oz.

8. 5 ft. 4 in.
6 ft. 10 in.

Subtract:

9. 39,544
29,655

10. 40,623
19,746

11. $\frac{5}{8}$
$\frac{1}{3}$

12. $2\frac{4}{5}$
$\frac{17}{20}$

13. .76
.056

14. 5.007
2.568

15. 5 gal. 3 qt.
2 gal. 2 qt.

16. 4 hr. 40 min.
2 hr. 55 min.

Multiply:

17. 618
300

18. 6432
406

19. $1\frac{2}{3} \times 6\frac{4}{5}$

20. $2\frac{2}{7} \times 8$

21. 25 × .006

22. 3.046 × .028

23. $\begin{array}{r} \text{4 bu. 2 pk.} \\ 6 \\ \hline \end{array}$

24. $\begin{array}{r} \text{6 yd. 6 in.} \\ 12 \\ \hline \end{array}$

Divide:

25. $28\overline{)6742}$

26. $75\overline{)62{,}425}$

27. $\frac{4}{5} \div 1\frac{1}{2}$

28. $4\frac{2}{5} \div 1\frac{1}{3}$

29. 4268 ÷ .002

30. 14.64 ÷ 2.2

31. $5\overline{)\text{49 tons 1200 lbs.}}$

32. $6\overline{)\text{3 mo. 18 da.}}$

Arrange the three numbers in each group according to size, largest to smallest:

33. .56, .557, 3.65

34. .8, .806, .89

35. 1.6, 1.68, 1.629

Change to per cents:

36. $\frac{5}{16}$

37. $\frac{1}{8}$

38. $1\frac{1}{4}$

Round off to nearest thousandths:

39. 1.4265

40. .5762

41. 16.0057

Change to common fractions:

42. .0625

43. .75

44. .375

45. $.08\frac{1}{3}$

Complete the following:

46. $33\frac{1}{3}\%$ of 600 = ____.

47. $\frac{1}{8}\%$ of 500 = ____.

48. ____% of 32 is 8.

49. 6 is ____% of 36.

50. $\frac{1}{2}\%$ of ____ is 24.

Chapter 8

Interest

UNIT 1

Simple Interest

When a person lends (or borrows) a sum of money, the amount loaned (or borrowed) is called the *principal.* A charge is made for the use of the principal. The charge received (or paid) is called the *interest.* The *time* is the number of years, or fraction of a year, for which the principal is loaned (or borrowed). The *rate* of interest is expressed as a per cent. The *amount* is the sum of the principal and interest.

The fundamental relations among these quantities are:

$$\begin{aligned}\text{Interest} &= \text{principal} \times \text{rate} \times \text{time}.\\ \text{Amount} &= \text{principal} + \text{interest}.\end{aligned}$$

An example will illustrate these ideas.

Example. Mr. Johnson borrows \$1000 from his friend, Mr. Stacy. Mr. Johnson agrees to repay the \$1000 at the end of two years, together with interest at 4% per year. Find the interest and the amount.

Solution. In this example, the *principal* is \$1000, the *rate* is 4%, and the *time* is two years. Then,

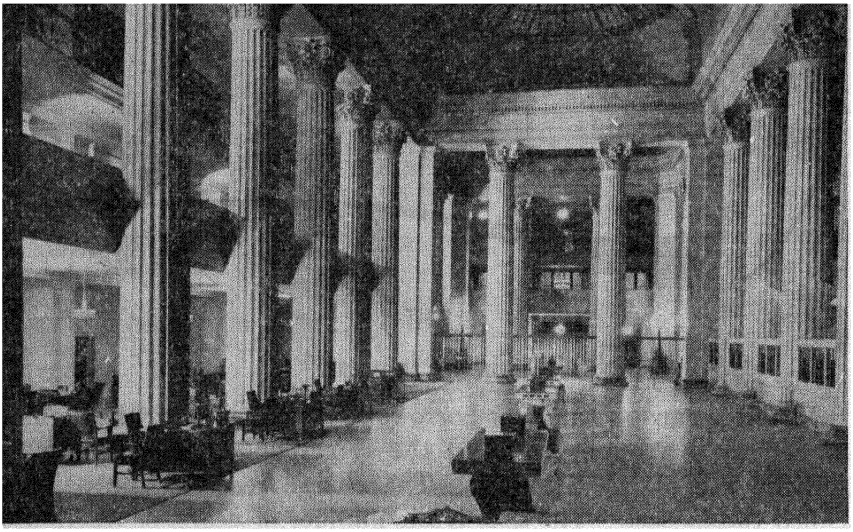
$$\begin{aligned}\text{Interest} &= \text{principal} \times \text{rate} \times \text{time}.\\ \text{Interest} &= \$1000 \times 0.04 \times 2 = \$80.\\ \text{Amount} &= \text{principal} + \text{interest}.\\ \text{Amount} &= \$1000 + \$80 = \$1080.\end{aligned}$$

Instead of expressing the rate as a decimal, we can express it as a common fraction. Thus,

$$\text{Interest} = \$1000 \times \frac{4}{100} \times 2 = \$80.$$

Cancellation can often be used to shorten the calculation. Thus,

$$\text{Interest} = \$\overset{10}{\cancel{1000}} \times \frac{4}{\cancel{100}} \times 2 = \$80.$$



A Bank Lobby. Interest on money loaned and on investments forms the principal income of the banks.

Problems

Group 1

In the following problems, the principal, rate, and time are given. In each problem find the interest and the amount.

1. \$1500 for 3 years at 5%.
2. \$200 for 2 years at 4%.
3. \$2000 for 5 years at 6%.
4. \$350 for 2 years at 6%.
5. \$225 for 4 years at 5%.
6. \$800 for 1 year at 7%.
7. \$470 for 2 years at $5\frac{1}{2}$%.
8. \$900 for 3 years at $6\frac{1}{2}$%.
9. \$670 for $1\frac{1}{2}$ years at 5%.
10. \$830 for $2\frac{1}{2}$ years at 4%.
11. \$625 for $2\frac{1}{2}$ years at $4\frac{1}{2}$%.
12. \$2000 for $3\frac{1}{2}$ years at $6\frac{1}{2}$%.
13. \$682.50 for 2 years at 5%.
14. \$489.50 for $1\frac{1}{2}$ years at $5\frac{1}{2}$%.
15. \$902.50 for $2\frac{1}{2}$ years at $4\frac{1}{2}$%.
16. \$300 for $\frac{1}{2}$ yr. at 5%.
17. \$400 for $\frac{1}{2}$ yr. at 3%.
18. \$600 for $\frac{1}{4}$ yr. at 6%.
19. \$80 for $\frac{1}{4}$ yr. at 7%.
20. \$249.75 for $\frac{1}{4}$ yr. at $4\frac{1}{2}$%.

Group 2

1. Joseph Custer borrowed \$1500 and \$1800 for 1 yr. at 6% interest. How much interest did he pay on each loan? What was the total amount repaid?

2. If the loans in Problem 1 had been made at 5%, what would be the interest paid?

3. Frank Sumner borrowed $440 for 2 yr. at 3%. What was the interest charge?

4. Joseph Lane loaned $900 to his brother for 1 yr. at 4½%. How much will he receive at the end of the year?

5. John Potts borrowed $800 for 1 yr. at 4% interest. How much did he repay at the end of the year?

6. John Cole borrowed $200 for 2 yr. at 5½% interest. How much did he repay when the loan became due?

7. Frank Straus borrowed from his aunt $500 for 1½ yr. at 2%. What did he have to repay his aunt?

8. John Jones loaned his friend Jack Richards $600 for 2½ yr. at 5%. How much must Jack Richards repay?

9. Jonathan Smith loaned $1250 to James Eastern for 1½ yr. at 6%. (*a*) How much interest did Mr. Eastern pay at the end of that time? (*b*) If the interest rate had been 4%, how much would the interest have been?

10. Joseph Steers made the following loans:

Ira Brown, $1850 at 6%
Charles Kane, $2600 at 5½%
Kenneth Roberts, $940 at 5%
Pat Bell, $2300 at 4½%

Assuming that all the loans were repaid at the end of 6 mo., find the total amount of interest that Joseph Steers received.

11. Richard Spur borrowed $4600 from his brother John. He repaid him 3½ yr. later with 4½% interest. How much did he repay John?

12. Richard Putnam borrowed $2650 from his father to open a dry goods store. He promised to repay him as soon as he could and also to pay interest at the rate of 2½% per annum. After 4½ yr. he found himself in a position to repay the loan. How much interest did he pay his father on the debt?

UNIT 2

Methods of Figuring Time

In the preceding lesson we found that the interest is found by multiplying together the principal, the rate, and the time. The principal and the rate are always given and therefore cause no difficulty. We are, however, often confronted with the problem of computing the time for ourselves. In the business and financial world three different methods are used—the *ordinary method,* the *exact method,* and the *bankers' method.*

Finding the Time by the Ordinary Method

In the ordinary method of finding the time, a year is considered as having 12 months of 30 days each, or 360 days.

Example 1. On March 6, 1959, Richard Dixon decided to repay Joseph Blick a sum of money he had borrowed on January 2, 1957. How much time elapsed between the two dates? (Use the ordinary method.)

Solution.

Yr.	*Mo.*	*Da.*
1959	3	6
1957	1	2
2	2	4

The result is 2 years, 2 months, and 4 days.

Sometimes it is necessary to borrow 1 month, or 1 year, or both, in a subtraction such as this.

Example 2. Find the elapsed time from July 23, 1958 to February 8, 1960. (Use the ordinary method.)

Solution.

Yr.	*Mo.*	*Da.*
1960	2	8
1958	7	23

Here we borrow 1 month from the 2 months, and, since 1 month is considered to be 30 days in the ordinary method, we change the 8 days to 38 days. Then it will be possible to subtract 23 days from 38 days. The solution now appears thus:

Yr.	*Mo.*	*Da.*
1960	1	38
1958	7	23

We cannot subtract 7 months from 1 month, so we borrow 1 year (12 months) from 1960, and add 12 months to 1 month, giving 13 months. The solution is now:

Yr.	*Mo.*	*Da.*
1959	13	38
1958	7	23
1	6	15

The final result is 1 year, 6 months, and 15 days.

Problems

Find the elapsed time by the ordinary method.

1. August 8, 1958 to November 12, 1959.
2. February 15, 1958 to July 20, 1960.

3. March 9, 1958 to December 23, 1961.
4. June 12, 1958 to October 28, 1960.
5. July 7, 1958 to September 16, 1955.
6. December 2, 1959 to January 10, 1961.
7. November 15, 1958 to July 7, 1959.
8. March 28, 1958 to January 3, 1960.
9. August 30, 1958 to May 14, 1961.
10. December 7, 1958 to December 12, 1960.

Finding the Time by the Exact Method

In finding the exact time, the actual number of days in each month is counted.

Example. A demand loan made on June 4, 1957, was called on Jan. 7, 1958. How much time has elapsed between the dates? (Use the exact method.)

Solution.

June,	26 da.
July,	31 da.
Aug.,	31 da.
Sept.,	30 da.
Oct.,	31 da.
Nov.,	30 da.
Dec.,	31 da.
Jan.,	7 da.
	217 da.

Note that the first day (June 4 in the problem) is not counted but that the last day (Jan. 7 in the problem) is.

A quick, convenient method of finding the exact time is to use a table of days. In a table of days, the days in a year are numbered from 1 to 365. January 1 is day number 1 and December 31 is day number 365.

To find the exact time from March 5 to November 28, first locate March 5 in the table. It is day number 64. Next, locate November 28 in the table. It is day number 332. Subtract 64 from 332: the result is 268, so there are 268 days from March 5 to November 28.

In the example at the beginning of this article, namely, to find the exact time from June 4, 1957 to January 7, 1958, proceed as follows. June 4 is number 155. Subtract 155 from 365; the result is 210. That is, it is 210 days from June 4 to the end of the year. Now locate January 7; it is number 7. Add to 210; the result is 217. It is therefore 217 days from June 4, 1957 to January 7, 1958.

THE NUMBER OF EACH DAY OF THE YEAR COUNTING FROM JANUARY 1

Day of month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Day of month
1	1	32	60	91	121	152	182	213	244	274	305	335	1
2	2	33	61	92	122	153	183	214	245	275	306	336	2
3	3	34	62	93	123	154	184	215	246	276	307	337	3
4	4	35	63	94	124	155	185	216	247	277	308	338	4
5	5	36	64	95	125	156	186	217	248	278	309	339	5
6	6	37	65	96	126	157	187	218	249	279	310	340	6
7	7	38	66	97	127	158	188	219	250	280	311	341	7
8	8	39	67	98	128	159	189	220	251	281	312	342	8
9	9	40	68	99	129	160	190	221	252	282	313	343	9
10	10	41	69	100	130	161	191	222	253	283	314	344	10
11	11	42	70	101	131	162	192	223	254	284	315	345	11
12	12	43	71	102	132	163	193	224	255	285	316	346	12
13	13	44	72	103	133	164	194	225	256	286	317	347	13
14	14	45	73	104	134	165	195	226	257	287	318	348	14
15	15	46	74	105	135	166	196	227	258	288	319	349	15
16	16	47	75	106	136	167	197	228	259	289	320	350	16
17	17	48	76	107	137	168	198	229	260	290	321	351	17
18	18	49	77	108	138	169	199	230	261	291	322	352	18
19	19	50	78	109	139	170	200	231	262	292	323	353	19
20	20	51	79	110	140	171	201	232	263	293	324	354	20
21	21	52	80	111	141	172	202	233	264	294	325	355	21
22	22	53	81	112	142	173	203	234	265	295	326	356	22
23	23	54	82	113	143	174	204	235	266	296	327	357	23
24	24	55	83	114	144	175	205	236	267	297	328	358	24
25	25	56	84	115	145	176	206	237	268	298	329	359	25
26	26	57	85	116	146	177	207	238	269	299	330	360	26
27	27	58	86	117	147	178	208	239	270	300	331	361	27
28	28	59	87	118	148	179	209	240	271	301	332	362	28
29	29	..	88	119	149	180	210	241	272	302	333	363	29
30	30	..	89	120	150	181	211	242	273	303	334	364	30
31	31	..	90	...	151	...	212	243	...	304	...	365	31

Note: For leap years, after February 28, the number of the day is one greater than that given in the table.

Problems

Find the elapsed time by the exact method:

1. August 3, 1958 to January 5, 1959.
2. March 6, 1959 to November 12, 1959.
3. April 12, 1959 to December 2, 1959.
4. September 10, 1959 to February 6, 1960.
5. January 3, 1959 to April 7, 1959.

6. March 23, 1959 to June 17, 1959.
7. June 1, 1958 to December 1, 1958.
8. November 7, 1958 to November 3, 1959.
9. July 6, 1959 to August 1, 1959.
10. August 20, 1960 to December 20, 1960.

Finding the Time by the Bankers' Method

In the bankers' method the time is expressed in months and days or in days only. This method is used to find the time for short periods.

EXAMPLE 3. On Oct. 25 the Universal National Bank calls a loan made on June 7. What is the elapsed time? (Use the bankers' method.)

SOLUTION.

Whole months..........	4 (June 7 to Oct. 7)
Additional days.........	18 (Oct. 7 to Oct. 25)
Total elapsed time......	4 mo. 18 da.

Application of Methods of Counting Time

The following problem illustrates the application of the counting of time to interest calculations:

EXAMPLE 4. Find the interest on $2000 at 6% from Nov. 16, 1960, to Apr. 8, 1961.

SOLUTION.

1. By the Ordinary Method:

Yr.	*Mo.*	*Da.*
1961	4	8
1960	11	16
	4	22

4 mo. 22 da. = 142 da.

$$\$2000 \times \frac{142}{360} \times \frac{6}{100} = \$47.33, \text{ interest.}$$

In this method a year is considered as having 12 months of 30 days each, or 360 days.

2. By the Exact Method:

Nov.,	14 da.
Dec.,	31 da.
Jan.,	31 da.
Feb.,	28 da.
Mar.,	31 da.
Apr.,	8 da.
	143 da.

$$\$2000 \times \frac{143}{365} \times \frac{6}{100} = \$47.01\text{, interest.}$$

In this method the year is considered as having 365 days.

3. By the Bankers' Method:

Nov. 16 to Mar. 16 = 4 mo.
Mar. 16 to Apr. 8 = 23 da.
4 mo. 23 da. = 143 da.

$$\$2000 \times \frac{143}{360} \times \frac{6}{100} = \$47.67\text{, interest.}$$

In this method the year is considered as having 360 days.

Problems

Find the elapsed time by the bankers' method:

1. June 2 to August 10.
2. January 8 to February 11.
3. March 12 to November 20.
4. February 2 to April 23.
5. April 20 to December 23.
6. April 18 to December 16.
7. May 24 to August 15.
8. June 26 to October 28.
9. July 4 to December 11.
10. July 3 to November 2.

Miscellaneous Problems

Find the interest in each problem by using (a) ordinary method of counting time, (b) exact method of counting time, and (c) bankers' method of counting time.

1. $3000 at 5% from Nov. 2, 1958 to Jan. 10, 1959.
2. $5000 at 6% from July 3, 1958 to March 3, 1959.
3. $2000 at 4% from August 8, 1960 to November 2, 1960.
4. $1000 at 6% from April 30, 1959 to September 12, 1959.
5. $600 at 5% from May 2, 1959 to June 2, 1959.
6. $1500 at 6% from June 12, 1959 to December 14, 1959.
7. $200 at 5% from July 28, 1959 to December 2, 1960.
8. $400 at 6% from August 5, 1958 to July 2, 1960.
9. $300 at 5% from September 22, 1958 to January 3, 1959.
10. $250 at 6% from October 20, 1958 to February 6, 1960.

UNIT 3

The 60-Day Method of Calculating Interest

IN AN ATTEMPT to simplify the calculation of interest, the business and financial world considers a year to have 12 months of 30 days each, or 360 days. With this basis interest may be calculated by what is known as the *60-day method*, which does away with a great deal of tedious computation. Let us compare this method of calculating interest with the old method.

We have just stated that a year contains 12 months of 30 days each, or a total of 360 days. Therefore, 60 days is equal to exactly $\frac{1}{6}$ of a year. If the interest rate for a full year is 6%, then the interest rate for 60 days will be $\frac{1}{6}$ of 6%, or 1%. In other words, the interest for 60 days at 6% is always 1% of the principal, and therefore, to find the interest on any sum for 60 days at 6%, it is necessary only to move the decimal point two places to the left.

Example 1. Thomas Budd's note to Mr. Jones for $500, bearing interest at 6% for 60 days, falls due today. How much is the interest?

Solution. *By Old Method:*

$$\$500 \times \frac{6}{100} \times \frac{60}{360} = \$5, \text{ interest.}$$

Solution. *By New Method:*

Principal, $500
$5, interest (decimal point has been moved two places to the left).

It is obvious that, if the interest for 60 days at 6% can be found so easily, we can find the interest for other periods which are aliquot parts of 60 days. Here are some examples:

Interest for 60 da.	Move decimal point two places to the left.
" " 30 "	Take $\frac{1}{2}$ of interest for 60 da.
" " 20 "	" $\frac{1}{3}$ " " " " "
" " 15 "	" $\frac{1}{4}$ " " " " "
" " 12 "	" $\frac{1}{5}$ " " " " "
" " 10 "	" $\frac{1}{6}$ " " " " "
" " 6 "	" $\frac{1}{10}$ " " " " " or merely move the decimal point three places to the left.

If you know the interest for 60 days at 6%, how would you find the interest for 600 days and 6000 days?

We shall solve a few problems by the 60-day method of figuring interest.

Example 2. Roger Smith owes $1800 on a 90-day loan bearing 6% interest. How much interest will he have to pay?

Solution.

Interest for 60 da. at 6% $18
Add interest for 30 da. at 6% $ 9 ($\frac{1}{2}$ of 60 da.)
$27, interest for 90 da. at 6%.

Proof. $$\$1800 \times \frac{90}{360} \times \frac{6}{100} = \$27, \text{ interest.}$$

Example 3. A loan made by Stephen Monroe for $2400, bearing interest at 6% for 45 days, falls due. What is the interest?

Solution.

Interest for 60 da. at 6%	$24
Less interest for 15 da. at 6%	$ 6 (¼ of 60 da.)
	$18, interest for 45 da. at 6%.

Proof.

Interest for 30 da. at 6%	$12 (½ of 60 da.)
Add interest for 15 da. at 6%	$ 6 (¼ of 60 da.)
	$18, interest for 45 da. at 6%.

Example 4. A. Geer's loan of $1260 for 96 days at 6% falls due. How much is the interest charge?

Solution.

Interest for 60 da. at 6%	$12.60
Add interest for 30 da. at 6%	$ 6.30 (½ of 60 da.)
Add interest for 6 da. at 6%	$ 1.26 (decimal point in $1260 moved three places to the left)
	$20.16, interest for 96 da. at 6%.

Proof. $\$1260 \times \frac{96}{360} \times \frac{6}{100} = \$20.16$, interest.

Example 5. What is the interest charge on a 29-day 6% interest-bearing loan of $1871?

Solution.

Interest for 60 da. at 6%	$18.71
Interest for 20 da. at 6%	$6.2367 (⅓ of 60 da.)
Add interest for 6 da. at 6%	$1.8710 (decimal point moved three places to the left)
Add interest for 3 da. at 6%	$ .9355 (½ of 6 da.)
	$9.0432, or $9.04, interest for 29 da. at 6%.

The solutions of interest problems should always be carried to four decimal places.

Proof.

Interest for 30 da. at 6%	$9.3550 (½ of 60 da.)
Less interest for 1 da. at 6%	$ .3118 (⅙ of 6 da. interest, or $1.871 ÷ 6)
	$9.0432, or $9.04, interest for 29 da. at 6%.

Interest problems solved by the 60-day method can be proved by using a combination of days different from that used in the original solution.

Problems

Group 1

Find the interest by the 60-day method. The interest rate in each case is 6%.

1. $1000 for 60 da.
2. $325 for 60 da.
3. $187.20 for 60 da.
4. $85.80 for 60 da.
5. $829.71 for 60 da.
6. $2000 for 30 da.
7. $1500 for 30 da.
8. $245.60 for 30 da.
9. $1346.92 for 30 da.
10. $29.46 for 30 da.
11. $3000 for 15 da.
12. $4200 for 15 da.
13. $840 for 15 da.
14. $192.60 for 15 da.
15. $240 for 15 da.
16. $2900 for 90 da.
17. $1650 for 90 da.
18. $1472 for 90 da.
19. $178.90 for 90 da.
20. $2800 for 45 da.
21. $9600 for 45 da.
22. $160 for 45 da.
23. $2700 for 66 da.
24. $3000 for 66 da.
25. $4260 for 29 da.
26. $840 for 63 da.
27. $1200 for 75 da.
28. $500 for 29 da.
29. $1643 for 96 da.
30. $8325 for 96 da.
31. $2400 for 6 da.
32. $1800 for 12 da.
33. $160 for 120 da.
34. $2000 for 120 da.
35. $780 for 33 da.
36. $1472 for 240 da.
37. $900 for 18 da.
38. $7200 for 20 da.
39. $8000 for 35 da.
40. $2800 for 18 da.

Group 2

1. A loan made by Richard Atkins for $3600, bearing interest at 6% for 45 days, falls due. What is the interest?

2. Jesse Atwood's note to Mr. White for $800, bearing interest at 6% for 30 da., falls due today. How much is the interest?

3. Roger Reynolds owes $3000 on a 90-day loan bearing 6% interest. How much interest will he have to pay?

4. B. T. Brown's loan of $9460 for 96 da. at 6% falls due. How much is the interest charge?

5. What is the interest charge on a 29-day 6% interest-bearing loan of $2476?

6. The Modern Finance Company made the following loans during a certain period. How much interest, at 6%, was collected altogether?

$1467 for 98 da.
$1764 for 68 da.
$1312 for 11 da.

7. Mr. Cox borrowed $125 from the United Finance Company at 6%. What was the amount he repaid 140 da. later?

8. John Starr sold some furniture to Elias Brinks. In payment Mr. Starr received a 6% interest-bearing note for $800 payable in 240 da. How much was due Mr. Starr at the expiration of the time?

9. Mr. Robert Johnson borrowed $418.92 for 60 da. at a 6% interest rate. How much interest did he pay?

10. Mrs. Althea Milton borrowed $234.28 for 120 da. at 6%. How much did she repay at the end of 120 da.?

UNIT 4

Simplified Methods of Finding Interest

INTEREST CALCULATIONS may be made easy by the use of a very simple rule of arithmetic. We know that the cost of five books at $2 a book is the same as the cost of two books at $5 a book. That is, we get the same answer when we multiply 2 × $5 as we do when we multiply 5 × $2. Applying the principle to interest calculations we see that the interest on $60 for 120 days is the same as the interest on $120 for 60 days. This principle, which is known as the *commutative law of multiplication,* often results in a saving of time in the finding of interest.

Interchanging the Principal and Number of Days

EXAMPLE. A $120 loan for 187 days, bearing interest at 6%, falls due. What is the interest?

If we try to find the interest on $120 for 187 days, we must break up the time into 60 days, 60 days, 60 days, 6 days, and 1 day and solve as follows:

SOLUTION.

Interest for 60 da.	$1.20
Add interest for 60 da.	$1.20
Add interest for 60 da.	$1.20
Add interest for 6 da.	$ .12
Add interest for 1 da.	$ .02
	$3.74, interest for 187 da.

However, the commutative law of multiplication tells us that the answer will be the same if we find the interest on $187 for 120 days. Therefore, we can solve much more quickly as follows:

SOLUTION. Interest for 60 da. $1.87

$1.87 × 2 = $3.74, interest for 120 da.

The saving of time is obvious. This rule of interchanging the principal and the time can be applied advantageously when the principal can be broken up easily into aliquot parts of 60 and the time cannot.

The 1-Day, or Product, Method

EXAMPLE. Find the interest on $198 for 98 days at 6%.

When neither the principal nor the time can be broken up easily into aliquot parts under the 60-day method, the *1-day*, or *product*, method sometimes helps. Under this method the interest is found for 1 day, and then that amount is multiplied by the total number of days.

FIRST SOLUTION. Interest for 6 da., $.198
$.198 ÷ 6 = $.033, interest for 1 da.
$.033 × 98 = $3.234, or $3.23, interest for 98 da.

SECOND SOLUTION. Interest for 6 da., $.198
$.198 × 98 = $19.404
$19.404 ÷ 6 = $3.234, or $3.23, interest for 98 da.

Problems

GROUP 1

By interchanging the principal and the time, find the interest at 6% on the following:

1. $60 for 120 da.
2. $60 for 87 da.
3. $600 for 183 da.
4. $30 for 84 da.
5. $30 for 123 da.
6. $90 for 92 da.
7. $90 for 124 da.
8. $90 for 67 da.
9. $15 for 150 da.
10. $15 for 237 da.
11. $15 for 181 da.
12. $300 for 231 da.
13. $300 for 118 da.
14. $120 for 67 da.
15. $120 for 29 da.
16. $45 for 88 da.
17. $45 for 92 da.
18. $45 for 102 da.
19. $600 for 312 da.
20. $450 for 196 da.

GROUP 2

Using the 1-day, or product, method, find the interest at 6% on:

1. $240 for 98 da.
2. $360 for 87 da.
3. $600 for 23 da.
4. $300 for 91 da.
5. $900 for 54 da.
6. $1200 for 65 da.
7. $246 for 76 da.
8. $3240 for 46 da.
9. $1836 for 73 da.
10. $2468 for 83 da.

UNIT 5

Computing Interest by the 60-Day Method at Rates Other Than 6%

UP TO this time all the problems we have solved by the 60-day method of finding interest have been based on an interest rate of 6%. In most states 6% is the legal rate, or the rate that may be collected on a debt when no rate is stated. That does not mean, however, that 6% must be charged. If a loan is large, and the credit of the borrower is excellent, the rate may be 5%, 4%, or less. In fact, loans have been made in the past to members of the Stock Exchange at rates as low as ½ of 1%. The question then arises as to how interest for rates other than 6% shall be computed.

EXAMPLE. The Apex Industrial Company negotiated a 90-day loan for $45,000 at 5% interest from the Travis National Bank. How much will the interest be?

FIRST SOLUTION.

Interest for 60 da. at 6%	$450
Add interest for 30 da. at 6%	$225
	$675, interest for 90 da. at 6%.

$675 ÷ 6 = $112.50, interest for 90 da. at 1%.
$675 − $112.50 = $562.50, interest for 90 da. at 5%.

SECOND SOLUTION. Interest for 90 da. at 6%, $675
$675 ÷ 6 = $112.50, interest for 90 da. at 1%.
$112.50 × 5 = $562.50, interest for 90 da. at 5%.

THIRD SOLUTION. Interest for 90 da. at 6%, $675
$675 × 5 = $3375
$3375 ÷ 6 = $562.50, interest for 90 da. at 5%.

The following tabulation is helpful in finding interest at rates more or less than 6% by the 60-day method.

To find the interest at a rate more or less than 6%, first find the interest at 6%. Then proceed as follows:

At 3%, take ½ of the interest at 6%.
At 4%, deduct ⅓ of the interest at 6%.
At 4½%, deduct ¼ of the interest at 6%.
At 5%, deduct ⅙ of the interest at 6%.
At 7%, add ⅙ of the interest at 6%.
At 7½%, add ¼ of the interest at 6%.
At 8%, add ⅓ of the interest at 6%.

Problems

Find the interest on the following:

1. $2400 for 60 da. at 5%.
2. $3600 for 60 da. at 4%.
3. $2520 for 60 da. at 3%.
4. $180 for 60 da. at 4%.
5. $2700 for 60 da. at 4%.
6. $2500 for 60 da. at 3%.
7. $3000 for 60 da. at 7%.
8. $2800 for 60 da. at 7½%
9. $4000 for 60 da. at 8%.
10. $1500 for 30 da. at 3%.
11. $2040 for 30 da. at 4%.
12. $4000 for 30 da. at 5%.
13. $200 for 30 da. at 7%.
14. $800 for 15 da. at 5%.
15. $900 for 15 da. at 3%.
16. $360 for 45 da. at 7%.
17. $740 for 45 da. at 7½%
18. $600 for 120 da. at 5%.
19. $300 for 120 da. at 8%
20. $450 for 80 da. at 3%.
21. $500 for 80 da. at 5%.
22. $1200 for 66 da. at 8%.
23. $180 for 150 da. at 4%.
24. $312 for 129 da. at 3%.
25. $1280 for 39 da. at 4½%.

UNIT 6

Exact or Accurate Interest

Large cities, as a rule, permit taxpayers to pay their annual tax bills in two installments 6 months apart. If, however, the payment is not made on time, a penalty in the form of interest is added. This interest is usually not computed by the ordinary method.

Generally, the Federal Government, state governments, and city governments, as well as banks which have large monetary transactions, base their interest calculations on a 365-day year rather than a 360-day year. Consequently, the 60-day method will not give the correct answer. Interest calculated on the basis of the exact number of days in a year is called *accurate* or *exact interest.* When this method is used, we count exact time.

Example 1. John Althrop was assessed taxes in the sum of $1580. He failed to pay the tax bill on time, remitting his payment 35 days after it was due. How much will he have to pay if interest is charged at the rate of 5% per annum?

Solution. $\$1580 \times \frac{5}{100} \times \frac{35}{365} = \$7.58$, exact interest.

$\$1580 + \$7.58 = \$1587.58$, amount due.

Changing Accurate Interest to Ordinary Interest, and Vice Versa

It is possible to convert ordinary interest into accurate interest by considering that ordinary interest is greater than accurate interest by as much as $\frac{360}{360}$ is greater than $\frac{360}{365}$, that is, by $\frac{5}{365}$, In order to find the ordinary interest, we must take $\frac{5}{360}$, or $\frac{1}{72}$, of the accurate interest and add this result to the accurate interest. Since ordinary interest is $\frac{5}{365}$ *greater* than accurate interest, we must subtract $\frac{5}{365}$, or $\frac{1}{73}$, from the ordinary interest to get the accurate interest.

To change accurate interest to ordinary interest, *add* $\frac{1}{72}$ of the accurate interest to itself.

To change ordinary interest to accurate interest, *deduct* $\frac{1}{73}$ of the ordinary interest from itself.

EXAMPLE 2. Find the exact interest in Example 1 by using the "conversion principle" (changing ordinary interest to exact interest).

SOLUTION.

Interest for 60 da. at 6%		$15.80
Interest for 30 da. at 6%	$7.9000	
Add interest for 5 da. at 6%	$1.3167	
	$9.2167, interest for 35 da. at 6%.	
Less interest for 35 da. at 1%	$1.5361	
	$7.6806, or $7.68, ordinary interest for 35 da. at 5%.	

$7.6806 ÷ 73 = $.1052

$7.6806 − $.1052 = $7.5754, or $7.58, exact interest.

EXAMPLE 3. The accurate interest on $1200 for 40 days at 6% is $7.89. Find the ordinary interest on the same amount for the same time at the given rate by using the "conversion principle."

SOLUTION. $7.89 ÷ 72 = $.1096, or $.11

$7.89 + $.11 = $8, ordinary interest.

PROOF.

Interest on $1200 for 60 da. at 6%	$12
Less interest for 20 da. at 6%	4
	$ 8, ordinary interest.

Problems

Find the exact interest on:

1. $2000 for 30 da. at 4%.
2. $500 for 35 da. at 5%.
3. $600 for 33 da. at 6%.
4. $800 for 15 da. at 5%.
5. $2400 for 70 da. at 6%.
6. $3000 for 100 da. at 4%.
7. $1000 from June 6 to June 30 at 5%.
8. $1500 from May 7 to June 15 at 6%.
9. $2000 from July 20 to September 22 at 4%.
10. $5000 from October 23 to December 2 at 5%.

By using the method of Example 1 and a rate of 5%, find the amount due:

	Taxpayer	*Tax Paid*	*Number of Days Late*
11.	James Burke	\$ 500	15
12.	Alexander Cunningham	\$1000	30
13.	Lester Walsh	\$ 277	35
14.	Henry Dunlap	\$ 150	84
15.	Howard Madison	\$ 300	72

In each case, compute the ordinary interest first and then change the ordinary interest to exact interest by the method of Example 2:

16. \$900 for 60 da. at 6%.
17. \$600 for 30 da. at 6%.
18. \$2000 for 15 da. at 5%.
19. \$800 for 23 da. at 6%.
20. \$300 for 40 da. at 5%.

Change the following amounts of ordinary interest to exact interest:

21. \$600. **22.** \$400. **23.** \$500. **24.** \$73. **25.** \$24.

Change the following amounts of exact interest to ordinary interest:

26. \$144. **27.** \$360. **28.** \$72. **29.** \$200. **30.** \$405.

UNIT 7

Compound Interest

SUPPOSE that an investor invests \$1000 in an investment that pays 4% per annum. Suppose, further, that he does not withdraw the interest, but instead leaves it in the investment to accumulate along with the principal. In this case he receives interest on the interest, and this situation is known as *compound interest.*

EXAMPLE 1. William Bruce deposits \$1000 today in a building and loan association that pays 4% per annum. How much does he have on deposit at the end of 1 year? If he allows the interest to remain on deposit, thus earning compound interest, how much does he have on deposit at the end of 2 years? 3 years? 4 years?

SOLUTION.

Amount of initial deposit	\$1000
Interest on \$1000 for 1 yr. at 4%	40
Amount on deposit at the end of 1 yr.	\$1040
Interest on \$1040 for 1 yr. at 4%	41.60
Amount on deposit at the end of 2 yr.	\$1081.60
Interest on \$1081.60 for 1 yr. at 4%	43.26
Amount on deposit at the end of 3 yr.	\$1124.86
Interest on \$1124.86 for 1 yr. at 4%	44.99
Amount on deposit at the end of 4 yr.	\$1169.85

Observe that the simple interest on \$1000 for 4 years at 4% is \$1000 × 4 × 0.04 = \$160. In the example, the interest earned is \$169.85. The difference of \$9.85 represents the excess of compound interest over simple interest. The excess is due to the fact that the interest is not withdrawn, but rather is left in the investment to accumulate interest.

Sometimes interest is computed semiannually or quarterly instead of annually. In this case, if the interest is not withdrawn but is left with the original investment to accumulate interest, the total will be even more than when the interest is computed annually.

EXAMPLE 2. Arnold Emerson deposits \$1000 in a savings bank that pays interest at the rate of 2% compounded semiannually. Find the amount he has on deposit at the end of 2 years.

SOLUTION.

Amount of original deposit	\$1000
Interest on \$1000 for ½ yr. at 2%	10
Amount on deposit at the end of ½ yr.	\$1010
Interest on \$1010 for ½ yr. at 2%	10.10
Amount on deposit at the end of 1 yr.	\$1020.10
Interest on \$1020.10 for ½ yr. at 2%	10.20
Amount on deposit at the end of 1½ yr.	\$1030.30
Interest on \$1030.30 for ½ yr. at 2%	10.30
Amount on deposit at the end of 2 yr.	\$1040.60

The theory of compound interest is studied in the mathematics of finance. It is the basis for the theory of annuities, depreciation, sinking funds, life insurance, and so forth.

Notice that the rate of 2% compounded semiannually is equivalent to 1% every 6 months. Likewise, a rate of 4% compounded quarterly would be equivalent to 1% every 3 months.

Problems

GROUP 1

Prepare a table, similar to those in Examples 1 and 2, showing the interest and the amount on deposit at the end of each period:

1. \$1200 for 3 years at 3% compounded annually.
2. \$2000 for 4 years at 2% compounded annually.
3. \$500 for 4 years at 3% compounded annually.
4. \$3000 for 2 years at 4% compounded semiannually.

5. $600 for 3 years at 4% compounded semiannually.
6. $1000 for 2 years at 2% compounded quarterly.
7. $2000 for 3 years at 4% compounded quarterly.
8. $1000 for 1 year at 3% compounded monthly.
9. $500 for 4 years at 2% compounded semiannually.
10. $500 for 4 years at 2% compounded quarterly.

Group 2

1. A man deposited $300 in a savings bank on July 1 and Jan. 2. If the bank adds interest at the rate of 4% per annum to the principal every 6 mo. and there were no other deposits or withdrawals, how much had he in the bank at the end of 3 yr.?

2. A man deposited $400 in a savings bank on Jan. 2 and July 1 of each yr. If the bank paid 4% interest per annum and added the interest to the principal every 6 mo., how much had he in the bank at the end of 3 yr.?

3. Theodore Haskell's bank pays interest at the rate of 3% compounded semiannually. If his bank balance 3 yr. ago was $860, and he has made no deposits or withdrawals, what is his balance now?

4. If you deposit $400 in a savings bank on Jan. 2 and $200 on July 1, what will be the compound interest at the end of the year if the rate of interest is 4% compounded semiannually?

5. If you deposit $100 on Jan. 2 and $100 on July 1 in a savings bank that adds interest at the rate of 4% per annum to the principal every 6 mo. and you make no withdrawals, how much will you have in the bank at the end of the yr.?

UNIT 8

Use of Compound Interest Tables

If we are required to find the balance of only one account in an investment trust company, the method used for compounding interest in Unit 7 may be used. But, since trust companies often have hundreds of investors, and each one has a different sum invested, it would be an enormous task to compute each one's interest and amount due at maturity by the method explained. And so, to ease this labor, and to speed up the calculation, trust companies, life insurance companies, and other financial institutions which find it necessary to compute compound interest have developed *compound interest tables.* Opposite is an example of one.

Now let us solve some problems in which compound interest tables are used.

Periods	½%	1%	1½%	2%	2½%	3%	3½%	4%	4½%	5%	5½%	6%
1	1.005000	1.010000	1.015000	1.020000	1.025000	1.030000	1.035000	1.040000	1.045000	1.050000	1.055000	1.060000
2	1.010025	1.020100	1.030225	1.040400	1.050625	1.060900	1.071225	1.081600	1.092025	1.102500	1.113025	1.123600
3	1.015075	1.030301	1.045678	1.061208	1.076891	1.092727	1.108718	1.124864	1.141166	1.157625	1.174241	1.191016
4	1.020151	1.040604	1.061364	1.082432	1.103813	1.125509	1.147523	1.169859	1.192519	1.215506	1.238825	1.262477
5	1.025251	1.051010	1.077284	1.104081	1.131408	1.159274	1.187686	1.216653	1.246182	1.276282	1.306960	1.338226
6	1.030378	1.061520	1.093443	1.126162	1.159693	1.194052	1.229255	1.265319	1.302260	1.340096	1.378843	1.418519
7	1.035529	1.072135	1.109845	1.148686	1.188686	1.229874	1.272279	1.315932	1.360862	1.407100	1.454679	1.503630
8	1.040707	1.082857	1.126493	1.171659	1.218403	1.266770	1.316809	1.368569	1.422101	1.477455	1.534687	1.593848
9	1.045911	1.093685	1.143390	1.195093	1.248863	1.304773	1.362897	1.423312	1.486095	1.551328	1.619094	1.689479
10	1.051140	1.104622	1.160541	1.218994	1.280085	1.343916	1.410599	1.480244	1.552969	1.628895	1.708144	1.790848
11	1.056396	1.115668	1.177949	1.243374	1.312087	1.384234	1.459970	1.539454	1.622853	1.710339	1.802092	1.898299
12	1.061678	1.126825	1.195618	1.268242	1.344889	1.425761	1.511069	1.601032	1.695881	1.795856	1.901207	2.012196
13	1.066986	1.138093	1.213552	1.293607	1.378511	1.468534	1.563956	1.665074	1.772196	1.885649	2.005774	2.132928
14	1.072321	1.149474	1.231756	1.319479	1.412974	1.512590	1.618695	1.731676	1.851945	1.979932	2.116091	2.260904
15	1.077683	1.160969	1.250232	1.345868	1.448298	1.557967	1.675349	1.800944	1.935282	2.078928	2.232476	2.396558
16	1.083071	1.172579	1.268986	1.372786	1.484506	1.604706	1.733986	1.872981	2.022370	2.182875	2.355263	2.540352
17	1.088487	1.184304	1.288020	1.400241	1.521618	1.652848	1.794676	1.947901	2.113377	2.292018	2.484802	2.692773
18	1.093929	1.196147	1.307341	1.428246	1.559659	1.702433	1.857489	2.025817	2.208479	2.406619	2.621466	2.854339
19	1.099399	1.208109	1.326951	1.456811	1.598650	1.753506	1 922501	2.106849	2.307860	2.526950	2.765647	3.025600
20	1.104896	1.220190	1.346855	1.485947	1.638616	1.806111	1.989789	2.191123	2.411714	2.653298	2.917757	3.207135
21	1.110420	1.232392	1.367058	1.515666	1.679582	1.860295	2.059431	2.278768	2.520241	2.785963	3.078234	3.399564
22	1.115972	1.244716	1.387564	1.545980	1.721571	1.916103	2.131512	2.369919	2.633652	2.925261	3.247537	3.603537
23	1.121552	1.257163	1.408377	1.576899	1.764611	1.973587	2.206114	2.464716	2.752166	3.071524	3.426152	3.819750
24	1.127160	1.269735	1.429503	1.608437	1.808726	2.032794	2.283328	2.563304	2.876014	3.225100	3.614590	4.048935
25	1.132796	1.282432	1.450945	1.640606	1.853944	2.093778	2.363245	2.665836	3.005434	3.386355	3.813392	4.291871

A Compound Interest Table.

EXAMPLE 1. Richard Lyons deposited $2000 in an investment trust, which promised to repay the money to him in 8 years with interest at 6% compounded annually. How much did Lyons receive at the end of the given period, and how much interest did he earn?

SOLUTION. By looking under 6% and opposite 8 in the table on page 125, we find that $1 compounded annually at 6% for 8 years amounts to $1.593848.

$2000 × $1.593848 = $3187.696000, or $3187.70, amount Mr. Lyons will receive.

$3187.70 − $2000 = $1187.70, compound interest.

EXAMPLE 2. If the investment trust in Example 1 had agreed to compound the interest semiannually, how much would Mr. Lyons have received at the end of the period, and how much interest would he have earned?

In using compound interest tables, we must reduce the rate to a compound basis. In the first problem no change was necessary, because the interest was compounded *annually*. In this problem, however, we really have 16 periods of interest at 3% each, inasmuch as each half-year Lyons receives 3% on his investment.

SOLUTION. Inspection of the compound interest table shows that $1 compounded for 16 periods at 3% amounts to $1.604706.

$2000 × $1.604706 = $3209.412000, or $3209.41, amount Mr. Lyons will receive.

$3209.41 − $2000 = $1209.41, compound interest.

Problems

GROUP 1

Using the compound amount table, find the amount of:

1. $2000 at the end of 4 years, at 6% compounded annually.
2. $5000 at the end of 20 years, at 3% compounded annually.
3. $4500 at the end of 25 years, at 2% compounded annually.
4. $1000 at the end of 10 years, at 4% compounded semiannually.
5. $600 at the end of 5 years, at 5% compounded semiannually.
6. $2400 at the end of 12 years, at 3% compounded semiannually.
7. $3000 at the end of 4 years, at 4% compounded quarterly.
8. $200 at the end of 5 years, at 6% compounded quarterly.
9. $800 at the end of 6 years, at 5% compounded semiannually.
10. $1000 at the end of 3 years, at 3% compounded semiannually.
11. $500 at the end of 11 years, at 5% compounded annually.
12. $500 at the end of 11 years, at 5% compounded semiannually.

13. $1000 at the end of 25 years, at 6% compounded annually.
14. $1000 at the end of 12 years, at 6% compounded semiannually.
15. $2000 at the end of 10 years, at 4% compounded semiannually.

GROUP 2

1. What will $2500 invested at 6% per annum compounded semiannually amount to at the end of 5 yr.? How much will the compound interest be?

2. Charles Walsh deposited $3000 in the Chelsea Trust Company at the age of 19. The investment paid him 6% interest compounded semiannually. What amount did Charles Walsh have on his twenty-eighth birthday?

3. The Chauncey Trust Company pays 4% interest to its investors annually. If Ralph Wright deposits $4000, how much will he have at the end of 10 yr.?

4. Thomas Cooper created a trust fund for his two sons, Arthur and Robert. He deposited $7000 in the Alberta Trust Company for Arthur and $7000 in the Montreal Trust Company for Robert. Each trust company paid 6% interest compounded semiannually. At the end of the seventh year, the Montreal Trust Company increased its interest rate to 7% compounded semiannually. How much more was in Robert's trust fund than in Arthur's at the end of the twelfth year?

5. A building and loan association pays interest on deposits at the rate of 3% per year. Find the amount of a deposit of $5000 at the end of 15 years.

6. A savings bank pays interest on deposits at the rate of 1% each half-year. A deposit of $2500 will amount to how much in 12 years?

7. How much will a trust fund of $2000 amount to in 10 years at 6% compounded semiannually?

Chapter Test—Review

GROUP 1

Find the interest on:

1. $3000 for 2 years at 4%.
2. $450 for $1\frac{1}{2}$ years at 5%.
3. $500 for 2 years at $4\frac{1}{2}$%.
4. $4000 for $2\frac{1}{2}$ years at $5\frac{1}{2}$%.

Find the time by the ordinary method:

5. August 2, 1958 to October 5, 1959.
6. June 20, 1958 to December 3, 1958.
7. May 23, 1958 to April 2, 1960.
8. October 3, 1958 to October 10, 1961.

Find the time by the exact method:

9. September 3, 1958 to October 4, 1959.
10. August 10, 1958 to January 2, 1959.
11. June 1, 1958 to October 2, 1958.
12. July 20, 1959 to September 10, 1959.

Find the time by the bankers' method:

13. June 4 to September 8.
14. April 20 to June 3.
15. May 12 to November 16.
16. September 21 to December 23.

Find the interest, using (a) ordinary method, (b) exact method, and (c) bankers' method of counting time:

17. $2000 at 6% from Oct. 3, 1958 to Jan. 8, 1959.
18. $4000 at 5% from June 18, 1958 to Nov. 10, 1958.
19. $1000 at 4% from May 8, 1959 to Oct. 9, 1959.
20. $500 at 3% from March 18, 1959 to Aug. 10, 1959.

Find the interest by the 60-day 6% method:

21. $1000 at 6% for 60 da.
22. $500 at 6% for 30 da.
23. $200 at 6% for 90 da.
24. $2000 at 3% for 60 da.
25. $300 at 3% for 30 da.
26. $4000 at 2% for 45 da.
27. $60 at 6% for 123 da.
28. $298 for 97 da. at 6%.
29. $300 for 206 da. at 6%.
30. $1200 for 91 da. at 3%.
31. $2700 for 60 da. at 4%.
32. $700 for 45 da. at 7½%.

Find the exact interest on:

33. $1640 for 34 da. at 4%.
34. $2000 for 69 da. at 5%.
35. $100 for 17 da. at 6%.
36. $324.96 for 23 da. at 4½%.

Change to exact interest:

37. $8.24 ordinary interest.
38. $14.28 ordinary interest.
39. $7.20 ordinary interest.

Change to ordinary interest:

40. $7.25 exact interest.
41. $14.10 exact interest.
42. $3.46 exact interest.

Find the compound interest:

43. $1000 for 2 years at 5% compounded annually.
44. $200 for 3 years at 4% compounded annually.
45. $5000 for 2 years at 6% compounded semiannually.
46. $800 for 3 years at 4% compounded quarterly.

Using the compound interest table, find the compound interest:

47. $1000 for 7 years at 5% compounded semiannually.
48. $200 for 4 years at 6% compounded quarterly.
49. $2000 for 9 years at 3% compounded semiannually.
50. $100 for 3 years at 2% compounded quarterly.

Group 2

1. Miss Alice Greeley borrowed $400 from her uncle for $1\frac{1}{2}$ yr. at 4%. How much interest did she pay?

2. On Nov. 12 the Security Bank calls a loan made on June 2. What is the elapsed time by the bankers' method?

3. J. P. Carleton borrowed $1000 from A. C. Murphy on June 2, 1952. He repaid it with interest at 5% on November 12, 1952. Compute the time by the ordinary method, the exact method, and the bankers' method. How much interest should he pay by each of these three methods?

4. Arthur Bell owes $2000 on a 90-day loan bearing 6% interest. How much interest will he have to pay? (Use the 60-day method of figuring the interest.)

5. Mr. Cooley borrowed $500 from a friend, who charged him 6% interest. He repaid the loan in 45 da. How much interest did he pay? (Use the 60-day method.)

6. A clerk has a large number of interest calculations to make. They are all for 90 da. at 5%. What short cut could he use to make all calculations?

7. James Hummel is 40 da. late in paying a tax bill of $1400. If the penalty rate is 4% per annum, how much does he pay? Use the exact method (365-day yr.).

8. Mrs. Horace McFarland deposits $400 in a federal savings association, which pays 4% compounded semiannually. How much does she have on deposit at the end of three years?

9. Approximately how long will it take money to double itself at an interest rate of 6% compounded annually? Compounded semiannually? (Use the compound interest table.)

10. How much will $75 amount to in 10 years at 3% compounded annually? Compounded semiannually? (Use the compound interest table.)

Speed Drills in Fundamentals

Test 4

Add:

1.	**2.**	**3.**	**4.**
284	358	$\frac{3}{4}$	$\frac{2}{3}$
623	740	$\frac{1}{8}$	$\frac{7}{12}$
865	271	$\frac{1}{16}$	$\frac{1}{2}$
708	205		
586	890		

5. .426 + .8 + .04 + 1.25

6. .709 + .81 + 5.403 + .0062

Subtract:

7. $\begin{array}{r}35612\\ \underline{27723}\end{array}$ **8.** $\begin{array}{r}8546\\ \underline{3658}\end{array}$ **9.** $\begin{array}{r}2\frac{5}{8}\\ \underline{\frac{11}{16}}\end{array}$ **10.** $\begin{array}{r}6\frac{3}{4}\\ \underline{2\frac{13}{14}}\end{array}$

11. .875 − .08
12. 3.0025 − .465

Multiply:

13. $\begin{array}{r}9820\\ \underline{406}\end{array}$ **14.** $\begin{array}{r}9034\\ \underline{78}\end{array}$ **15.** $\frac{5}{8} \times \frac{3}{4}$ **16.** $5\frac{2}{5} \times 7\frac{7}{8}$

17. 200 × .02
18. 4.75 × .005

Divide:

19. $42\overline{)3184}$
20. $84\overline{)4132}$
21. $8\frac{2}{3} \div 2$
22. $6\frac{1}{2} \div 6$
23. $.016\overline{)6.992}$
24. $40\overline{).012}$

Convert:

25. 6 ft. = ____ in.
26. 8 qt. = ____ pt.
27. 4 yd. = ____ in.
28. 7 gal. = ____ qt.

Change to per cents:

29. $\frac{3}{5}$
30. $\frac{5}{8}$
31. .16
32. .125
33. $\frac{1}{8}$
34. $\frac{3}{10}$
35. $\frac{5}{6}$
36. 1.25

Change to fractions:

37. .48 **38.** .625 **39.** $.16\frac{2}{3}$ **40.** $2.87\frac{1}{2}$

Change to decimals:

41. $\frac{1}{50}$ **42.** $\frac{2}{3}$ **43.** $\frac{3}{200}$ **44.** $\frac{1}{8}$

Complete:

45. 4% of 400 is ____.
46. $16\frac{2}{3}$% of 300 is ____.
47. 30 is ____% of 60.
48. ____% of 42 is 84.
49. \$5.00 is ____% of \$75.
50. $\frac{1}{8}$% of ____ is 25.

Chapter 9 Checking and Savings Accounts

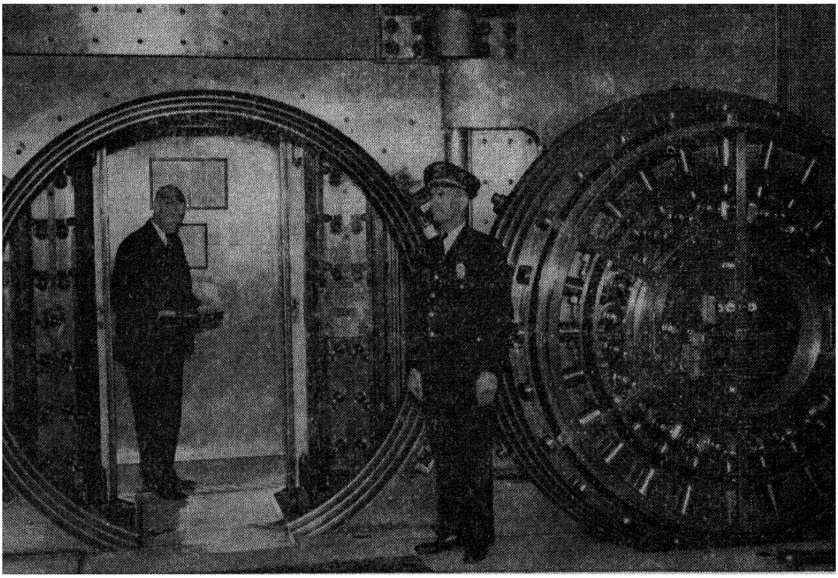
UNIT 1

The Personal Checkbook

WHEN a person opens a checking account at a bank, the bank gives him a *checkbook* and a *passbook*. Also, he signs a *signature card* to verify his signature. His first deposit, and all subsequent deposits, are recorded in his passbook. Each time he makes a deposit, he fills out a *deposit slip*.

The bank teller records the amount of the deposit in the passbook, showing the date on which the deposit is made.

The customer enters the deposit in his checkbook. When he writes a check, he enters the amount of the check, the person or firm to whom the check is written, and the purpose for which it is



A Bank Vault. Here are kept money, securities, and safety deposit boxes for customers.

written on the checkbook stub. The checkbook stub should be made out first, before the check is written.

The job of keeping the checkbook stubs accurately is one of the most important business experiences of many persons. The arithmetic is simple, involving only addition and subtraction, but here accuracy is vital in order to maintain a correct record of checks and balances.

We shall illustrate the procedure with an example.

Example. Robert Anderson opens a checking account at the Security Bank. His first deposit consists of a check for $500, $25 in currency, and $3.85 in coins. He prepares the deposit slip:

Checking Account

SECURITY BANK

Deposit for credit of *Robert Anderson*

Date *January 10, 19—*

	Dollars	Cents
Currency	*25*	—
Coin	*3*	*85*
Checks	*500*	—
Total	*528*	*85*

The bank teller enters the deposit in the passbook:

SECURITY BANK

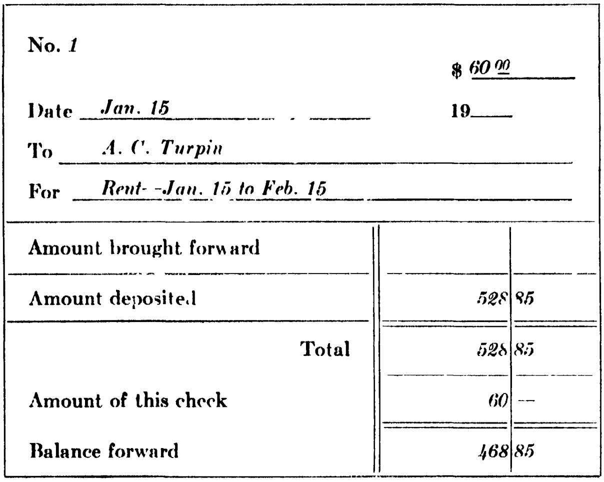
Commercial Account with

Robert Anderson

Jan. 10, 19__	*AB*	*528*	*85*

Mr. Anderson enters the deposit on his checkbook stub. A few days later, he writes a check to pay his rent. He enters the check on his checkbook stub and subtracts the amount of the check from his first deposit to obtain the balance.

He carries the balance forward to the next stub. Future deposits are extended in the passbook by the bank teller, and on the checkbook stubs by Mr. Anderson.



No. *1*

$ *60 00*

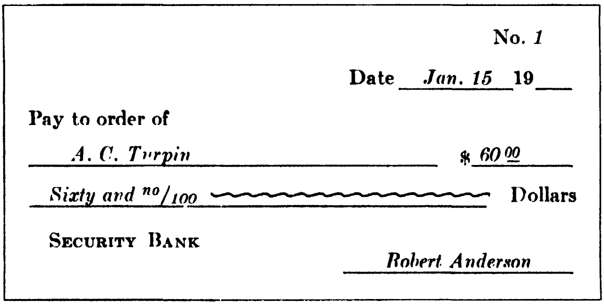
Date *Jan. 15* 19

To *A. C. Turpin*

For *Rent—Jan. 15 to Feb. 15*

Amount brought forward		
Amount deposited	*528*	*85*
Total	*528*	*85*
Amount of this check	*60*	*--*
Balance forward	*468*	*85*

Checkbook Stub (enlarged).



No. *1*

Date *Jan. 15* 19

Pay to order of

A. C. Turpin $ *60 00*

Sixty and no/100 Dollars

SECURITY BANK

Robert Anderson

Check (reduced).

Problems

Complete the missing entries on the following series of checkbook stubs

1. Checkbook stub No. 1:

Amount brought forward	$368.75
Amount deposited	48.50
Total	$______
Amount of this check	17.68
Balance forward	$______

Checkbook stub No. 2:

Amount brought forward	$____
Amount deposited	72.45
Total	$____
Amount of this check	9.18
Balance forward	$____

Checkbook stub No. 3:

Amount brought forward	$____
Amount deposited	23.78
Total	$____
Amount of this check	10.25
Balance forward	$____

2. Checkbook stub No. 1:

Amount brought forward	$200.95
Amount deposited	—
Total	$____
Amount of this check	15.75
Balance forward	$____

Checkbook stub No. 2:

Amount brought forward	$____
Amount deposited	58.90
Total	$____
Amount of this check	25.10
Balance forward	$____

Checkbook stub No. 3:

Amount brought forward	$____
Amount deposited	—
Total	$____
Amount of this check	15.77
Balance forward	$____

3. Total the following deposit slips:

	#1	*#2*	*#3*
Currency	$23.00	$198.00	$435.00
Coin	18.79	78.98	78.66
Check	14.90	19.00	78.00
Check	75.65	54.15	54.67
Check	9.00	20.00	87.19
Check	10.00	25.00	65.87

Add each of the following deposit slips:

4.

	Jones
Bills	$224.00
Coins	—
Checks	357.89
	423.53
	89.57
	153.36
	46.25
	65.98
	$

5.

	Barton
Bills	—
Coins	—
Checks	$ 96.72
	305.48
	64.36
	368.79
	276.97
	43.85
	$

6.

	Cooper
Bills	$347.00
Coins	12.74
Checks	575.23
	328.72
	70.78
	84.29
	179.27
	467.34
	$

Find the balance of each of the following bank accounts:

	Total Deposits Made	*Checks Drawn*
7.	$675	$83, $56
8.	$1964	$43, $89, $173
9.	$1647	$294.50, $8.25, $78
10.	$2454.25	$153.40, $60.90, $378.25

UNIT 2

The Bank Reconciliation Statement

BANKS render statements to their depositors so that the depositors may verify their balances with those of the bank. Many times the depositor's records are not in agreement with the bank's, for the reason that (1) some checks issued by the depositor have not yet been presented to the bank or (2) the depositor has not entered certain charges or credits to his account. The procedure used in reconciling the depositor's records with the bank statement is as follows: (1) Compare the checks issued with the canceled checks returned by the bank; (2) prepare a list of checks not returned (called *outstanding checks*); (3) deduct the total outstanding checks from the bank balance; (4) adjust the checkbook balance for any other charges or credits. There are reconciliation statements which may include other adjustments. These two general rules will guide you in preparing such statements:

Rule 1. Do to the bank balance what has already been done to the checkbook balance.

Rule 2. Do to the checkbook balance what the bank has already done to the bank balance.

Let us consider the case of Mr. Gerald Blake, who has a checking account with the Merchants' Bank. On September 1 he received a statement from his bank, as follows:

THE MERCHANTS' BANK

STATEMENT KEY

ACCOUNT OF

Gerald Blake
1687 Maine Street
City

EC—ERROR CORRECTED
CC—CERTIFIED CHECK
M—MAIL DEPOSIT
IN—INTEREST CREDIT
RT—RETURNED ITEM
CM—CHG. OR CREDIT MEMO
LST—TOTAL CHECKS

Branch N
Number

Date	*Checks—Read Across*			*Date*	*Deposits*	*Balance*
19—				19—		
				Aug. 3	600.00	600.00
Aug. 10	150.00	30.00				420.00
				12	130.00	550.00
15	12.00			15	210.00	748.00
18	14.00	32.00	10.00	18	412.00	1104.00
22	22.50	12.75				1068.75
				25	312.50	1381.25
27	36.10	18.50	25.00	27	136.25	1437.90
				30	124.75	1562.65
31	1.35			31	249.20	1810.50

The closing balance on this statement is $1810.50. Mr. Blake's checkbook shows a balance of $1685.75. In order to reconcile the bank statement balance with the checkbook balance, he proceeds as follows. First, he compares the checks listed in the bank statement with those listed on his checkbook stubs. In doing this, he finds that there are three checks that have been written by him that do not appear on the bank statement. This means that they have been issued but have not yet been received by the bank. Also, the bank statement lists a service charge of $1.35 on August

31, which naturally does not appear on his checkbook stubs. Mr. Blake now prepares the bank reconciliation statement shown below.

GERALD BLAKE

Bank Reconciliation Statement

Sept. 1, 19—

Balance per Checkbook	$1685.75	Balance per Bank Statement		$1810.50
Deduct:		Deduct:		
Service Charges	1.35	Checks Outstanding:		
		#23	$60.80	
		#26	40.30	
		#32	25.00	
		Total Checks Outstanding		126.10
Adjusted Checkbook Balance	$1684.40	Available Bank Balance		$1684.40

Problems

Group 1

1. Henry Stone opened a checking account with $500. He made no other deposits. He drew checks for $100 and $50. When his bank statement arrived, it showed a balance of $400. He did not receive the canceled $50 check. His checkbook balance was $350. Explain how you would reconcile the two balances.

2. Mrs. Al James found that her bank balance on June 1 was $640, while her checkbook balance was $562. She found that the following checks had not been deducted from the bank balance: #167, $14; #169, $18, and #170, $46. Find the total amount of the outstanding checks, and show that this total reconciles the bank and checkbook balances.

3. On Sept. 1 the checkbook balance of Forbes and Co. was $1372. The outstanding checks amounted to $68. What was the bank balance?

4. On Nov. 1 Mr. Kane's bank balance amounted to $1560, and the outstanding checks amounted to $72. What was his checkbook balance?

5. Richard Hastings' checkbook balance was $1650.50. His bank statement showed a balance of $1651.75, a credit of $2.50 for interest, and a charge of $1.25 for collections. There were no outstanding checks. Reconcile the checkbook and bank statement balances.

Group 2

1. On June 1 George Walsh received his bank statement, which showed a bank balance of $4650. His checkbook balance was $4460. His outstanding checks were as follows: #86, $70; #73, $68; and #92, $52. Prepare a statement reconciling the bank balance and the checkbook balance.

2. The checkbook of Thomas Stone showed a balance of $7941.02. His March bank statement showed a balance of $8605.92. His outstanding checks were as follows: #93, $116; #104, $420; #117, $118; and #126, $12. The bank deducted a service charge of $1.10, which he had not taken into account. Prepare a reconciliation statement.

3. Joseph Steeple received from the American Industrial Bank on Feb. 1 a bank statement showing a balance of $6402.18. His checkbook balance on that date was $6125.13. The outstanding checks were as follows: #182, $120; #194, $116.30; #201, $26.05; and #216, $16. He had made no provision on his check stubs for a service charge of $2.35 and an interest credit of $1.05. Reconcile the checkbook with the bank statement.

4. On May 1 Richard Chase received his bank statement, which showed a balance of $9203.45. Comparison of the canceled checks with his check stubs showed the following checks outstanding: #132, $84; #145, $93.17; #164, $86.50; #173, $119.27; #182, $165. He found that a check issued for $63.65 had been erroneously entered on the check stub as $36.65. His bank had charged $1.15 for service charges which he had not entered on his check stubs. Reconcile his checkbook balance of $8683.66 with his bank statement balance.

5. On May 31 Frank Arnold's bank balance was $1232.15, and his checkbook balance was $663.96. Deposits of $138.70 and $206.25 were not recorded on the stubs of the checkbook, while checks for the following amounts had not been presented for payment: $76.18, $17.06, and $130. (*a*) Reconcile the balances. (*b*) What is the correct checkbook balance?

6. On Apr. 1 C. J. Ames's checkbook balance was $1567.50. On the same date the monthly statement from the bank showed a balance of $1728.40. Checks for the following amounts were outstanding: $89.50, $76.42, and $27.48. A comparison of the statement with the checkbook showed that the following items, which were not recorded in the checkbook, had been paid: A canceled check for $19.20, a charge of $2.90 for banking service, and a tax on checks amounting to $1.40. The amount of one of the canceled checks was $221, while the amount on the checkbook stub was $212. (*a*) Reconcile the balances. (*b*) What is the correct checkbook balance?

UNIT 3

The Savings Account

PRESENT standards of living demand that one prepare for the time when he no longer is able to earn, as well as for emergencies; and, as a result, the method of investing surplus funds is important.

One of the most popular methods is that of putting surplus monies in a savings bank, since the depositor may start with a small amount, deposit at will, withdraw almost as easily, secure compound interest on his deposits, and be assured that the money is protected by government insurance, regulations, and supervision. Interest on savings accounts is computed by the compound interest method and according to special rules adopted by individual banks. Interest is computed on whole dollars only.

EXAMPLE 1. Compute the interest on $324.87 for 6 months at $2\frac{1}{2}\%$ per annum.

SOLUTION. Using whole dollars only,

$$\$324 \times \frac{6}{12} \times .025 = \$4.05.$$

Practices in computing the interest on savings accounts vary widely among banks. A commonly used method follows.

EXAMPLE 2. Mr. Robert Anderson's savings account passbook shows the following deposits and withdrawals:

Term Savings Account with Robert Anderson

SECURITY BANK

Date	*Entered by*	*Withdrawn*	*Deposited*	*Balance*
July 15, 1958	A.B.		792.81	792.81
Sept. 13, 1958	C.M.	260.00		532.81
Oct. 5, 1958	A.B.	200.00		332.81
Oct. 17, 1958	C.M.		271.00	603.81
Jan. 4, 1959	C.M.		544.53	1148.34

Interest is written on June 30 and December 31, at the rate of 2% per annum. In the period from June 30, 1958 to Dec. 31, 1958 the above passbook shows that the smallest balance in this account was $332.81. Interest is computed on this amount, to whole dollars only, for 6 months at 2% per annum.

SOLUTION.

$$\$332 \times \frac{6}{12} \times .02 = \$3.32.$$

When Mr. Anderson brings his passbook to the bank on January 4, 1959 to make a deposit, the bank teller writes

Dec. 31, 1958. Interest $3.32.

in the "Deposited" column and adds this to the balance.

Practices Commonly Used in the Computing of Interest on Savings Bank Accounts

1. Interest is allowed from the day of deposit on money left until the end of the quarter and is compounded quarterly.
2. Interest is allowed from the first of each month on money left until the end of the quarter and is compounded quarterly.
3. Interest is allowed every three months and is compounded quarterly.
4. Interest is allowed for each full calendar month that money is on deposit and is compounded semiannually.
5. Interest is allowed from the first of each month on money left until the end of the quarter and is compounded semiannually.
6. Interest is allowed from the first of each month on money left until the end of the semiannual period and is compounded semiannually.
7. Interest is allowed quarterly and is compounded semiannually.
8. Interest is allowed from the first of each month on money left any three full calendar months and is compounded quarterly.
9. Interest is allowed from the day of deposit on money left until the end of the semiannual period and is compounded semiannually.
10. Interest is allowed from the first three days of each month on money left any three full calendar months and is compounded semiannually.

These various practices are listed here merely to show how widely banks vary in methods of computing interest on savings accounts. *In the problems we shall use the method of Example 2.*

Problems

Group 1

Find the interest on the following as computed by a savings bank. Use whole dollars only.

1. $160.75 for 3 mo. at 2% per annum.
2. $360.25 for 3 mo. at $2\frac{1}{2}$% per annum.

3. **$560 for 6 mo. at 3% per annum.**
4. **$822 for 6 mo. at 3% per annum.**
5. **$214.63 for 6 mo. at 3% per annum.**
6. **$2136.28 for 6 mo. at 3% per annum.**
7. **$2050 for 6 mo. at 2½% per annum.**
8. **$512.82 for 3 mo. at 3% per annum.**
9. **$856.24 for 6 mo. at 3% per annum.**
10. **$1400 for 3 mo. at 2½% per annum.**

Group 2

By the method of Example 2 compute the interest due on the following savings accounts. Use an interest rate of 3% per annum. Compute each balance.

1.

Date	Withdrawn	Deposited	Balance
July 3		$512.98	$512.98
Aug. 4		$234.16	
Sept. 5		$118.92	
Oct. 10	$200.00		
Nov. 3		$172.16	
Dec. 31		Interest	

2.

Date	Withdrawn	Deposited	Balance
Jan. 2		$500.00	
Feb. 3		$488.16	
April 23	$600.00		
May 15		$412.29	
June 30		Interest	

3.

Date	Withdrawn	Deposited	Balance
Jan. 1		$1500.00	
Mar. 6		$823.00	
April 10		$416.00	
May 6	$300.00		
July 1		Interest	

4.

Date	Withdrawn	Deposited	Balance
July 29		$1222.30	
Sept. 11	$500.00		
Oct. 2	$200.00		
Oct. 30		$676.76	
Nov. 1	$300.00		
Dec. 8	$200.00		
Dec. 31		Interest	

5.

Date	Withdrawn	Deposited	Balance
Jan. 1		$405.00	
Mar. 2		$236.50	
April 23	$100.00		
June 30		Interest	
July 15		$316.20	
Sept. 3	$250.00		
Nov. 16		$158.19	
Dec. 31		Interest	

6.

Date	Withdrawn	Deposited	Balance
Jan. 1		$1000.00	
Feb. 1		$500.00	
Mar. 1		$300.00	
April 1	$800.00		
June 30		Interest	
August 15		$600.00	
Oct. 20	$200.00		
Dec. 31		Interest	

7.

Date	Withdrawn	Deposited	Balance
Jan. 1		$625.63	
Feb. 1		$728.65	
March 1		$715.24	
April 8	$1200.00		
May 1		$725.55	
June 30		Interest	

Chapter Test—Review

1. Complete the missing entries:

Checkbook stub No. 1:	
Amount brought forward	$247.83
Amount deposited	29.36
Total	$
Amount of this check	15.24
Balance forward	$
Checkbook stub No. 2:	
Amount brought forward	$
Amount deposited	16.72
Total	$
Amount of this check	5.46
Balance forward	$

2. Total the deposit slip:

Currency	$134.67
Coin	16.27
Check	10.50
Check	9.75
Check	15.75
Check	23.50

3. Find the balance: total deposits made, $426.87; checks drawn, $25.17, $16.28, $25.50.

4. Reconcile the bank statement:

Date	*Checks*		*Date*	*Deposits*	*Balance*
			March 28	$300.00	$300.00
March 29	20.00	10.50			269.50
March 30	15.00	20.75		83.33	317.08
April 2	5.00			150.00	462.08

Outstanding checks for $25.60 and $12.50.

Bank service charges, $1.30.

5. By the method of Example 2, Unit 3, compute the interest due on the following savings account on Dec. 31.

Date	*Withdrawn*	*Deposited*	*Balance*
July 2		647.68	647.68
Aug. 2		43.12	690.80
Sept. 3		71.25	763.05
Nov. 10	200.00		563.05
Dec. 3		41.98	605.03

Speed Drills in Fundamentals

Test 5

Add and change answer to nearest cent:

1. $6.7241
2.4337
.7295
.3648

2. $3.4765
1.7587
2.8978
.3686

3. $4.1212
2.8763
1.3333
.1429

Add:

4. $18\frac{3}{4}$
$3\frac{2}{3}$
$24\frac{1}{6}$

5. $27\frac{5}{8}$
$34\frac{4}{5}$
$46\frac{3}{4}$

6. $57\frac{2}{3}$
$76\frac{5}{6}$
$38\frac{3}{4}$

Subtract:

7. $1.065 – $.875

8. $.964 – $.086

9. $115\frac{1}{6} - 26.4$

Multiply:

10. $\$.67\frac{1}{2} \times 19$
11. $483 \times 43,625$
12. $428 \times \$63\frac{1}{2}$
13. $.96 \times 12\frac{1}{2}$
14. $.96 \times \frac{1}{8}$
15. $1.34\frac{3}{8} \times 19\frac{1}{2}$

Divide:

16. $\frac{5}{8} \div \frac{5}{9}$
17. $\frac{5}{12} \div \frac{7}{8}$
18. $\frac{3}{5} \div \frac{15}{16}$
19. $\$16.50 \div \$63\frac{1}{2}$
20. $2\frac{1}{2} \div .025$
21. $\$74 \div \$.058$

Change to denomination indicated:

22. 5 bu. = ____ pk.
23. 6 lbs. = ____ oz.
24. 160 pt. = ____ qt.

Find exact number of days:

25. Aug. 11 to Sept. 9.
26. Aug. 6 to Feb. 1.
27. Sept. 14 to March 10.
28. Dec. 16 to June 11.

Complete the proportion:

29. 10 : 12 = ? : 24
30. 15 : 5 = 45 : ?
31. ? : 2 = 98 : 7
32. 3 : ? = 26 : 78

Change to decimals:

33. $\frac{5}{16}$
34. $\frac{9}{12}$
35. $\frac{4}{5}$
36. $\frac{9}{8}$
37. $1\frac{1}{3}$

Change to fractions:

38. 30%
39. $66\frac{2}{3}\%$
40. 24%
41. .375
42. 8%

Complete:

43. $137\frac{1}{2}\%$ of 960 is ____.
44. $14\frac{7}{8}\%$ of 500 is ____.
45. 80 is 25% of ____.
46. 48 is 20% of ____.
47. ____% of 50 is 60.
48. ____% of 90 is 50.
49. 48 is ____% of 192.
50. 20% of ____ is 12.

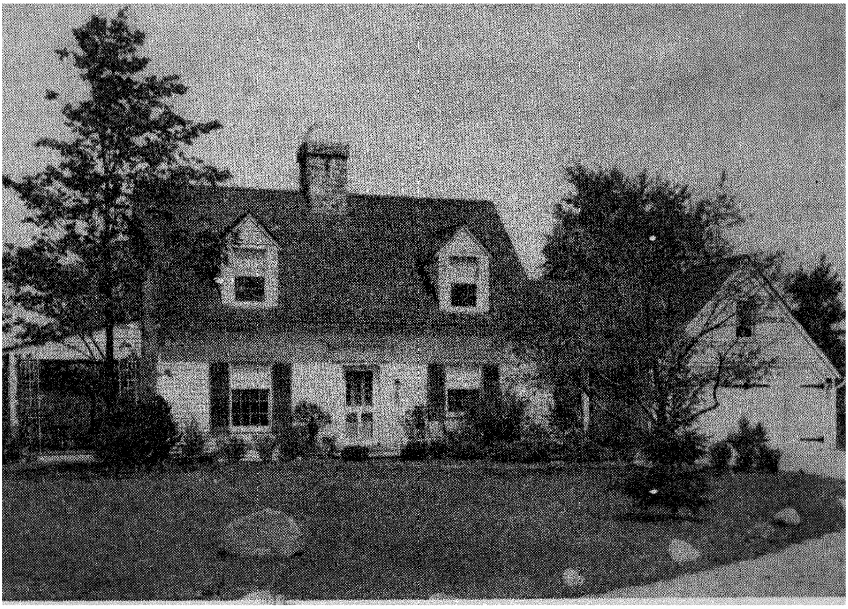
Chapter 10

Owning and Maintaining a Home

When You Buy a House

THE PURCHASE of a home is usually the largest financial transaction undertaken by the average family. Purchasing food and clothing is a common experience, but buying a house is an event that occurs only once in the lives of many people.

Many important decisions must be made before selecting a house. Schools, markets, neighborhood, taxes, and transportation must be considered in determining the location. The type of house, its size, the kind of materials used, the size of the family income, and the



A Typical American Home. Finding the right place to live is one of the most important problems an individual or family has to face.

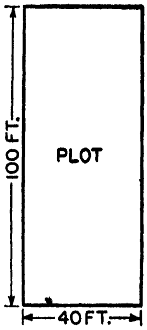
permanence of the buyer's job must all be considered before the buyer signs a contract.

UNIT 1

Buying the Lot

Whether a person buys a house which is already built or builds a house according to his own plans, there are important factors in the selection of the location. How large is the lot? How many street improvements are to be paid for? Is there proper drainage? What are the building restrictions? Can the house be placed to take advantage of sunlight and view? How long is the driveway?

Example 1. Your father decides to build a home for the family, and, after looking over several plots of land offered by a real estate broker, he selects one measuring 40 ft. by 100 ft., the price of which is 31½¢ a square foot. (*a*) What price will your father pay for this land? (*b*) How much will the seller receive if the broker's commission is 2½%?



Business concerns employ salesmen to sell their merchandise. In the same way, property owners who wish to sell their real estate employ *real estate brokers.* These brokers are licensed by the state, and the commission rates which they are permitted to charge are regulated by law. Rates vary in different localities. In one large city, for example, on sales up to and including $100,000, the commission rate is 2½%; from $100,000 to $1,000,000, the rate is 1½%; from $1,000,000 to $2,000,000, the rate is 1¼%; and over $2,000,000, the rate is 1%. Outside of the city, the commission is usually 5% on small sales. The seller, and not the buyer, pays the commission.

Solution.

(*a*) 40 ft. × 100 ft. = 4000 sq. ft.
4000 × $.31½ = $1260, price paid by buyer.
(*b*) 2½% of $1260 = $31.50, broker's commission.
$1260 − $31.50 = $1228.50, proceeds to seller.

In the example, the price of the land was based on the *square foot,* but land is also sold by what is known as the *front foot.* That means merely that the price is based on the width of the land and is not affected by the depth.

EXAMPLE 2. A plot of land 40 ft. by 100 ft. is sold for $75 a front foot. (*a*) What is the gross selling price? (*b*) What is the net selling price if the broker's commission is $2\frac{1}{2}\%$?

In this problem the only figure needed, besides the price, is the number of front feet. Real estate dimensions always specify the size of the front of the property first and the number of feet it runs back second. In this problem the length of the land facing the street is 40 feet, while the length of the plot running backward is 100 ft.

SOLUTION.

(*a*) 40 × $75 = $3000, gross selling price.
(*b*) $2\frac{1}{2}\%$ of $3000 = $75, broker's commission.
$3000 − $75 = $2925, net selling price.

Besides being sold by the square foot or front foot, land is also sold by the *lot*. Large tracts of land that are purchased for farms or for building developments are known as *acreage*, since they are bought by the *acre*.

A person who buys real estate should engage the services of a capable attorney, who will attend to such matters as searching the title, getting the title guaranteed, and closing the title. The cost to the buyer will be the price paid for the property plus legal fees and other expenses.

Problems

GROUP 1

Determine the value of each of the following plots of land:

	Plot	*Price*
1.	20 ft. by 100 ft.	$1 per square foot
2.	40 ft. by 100 ft.	$4 per square foot
3.	100 ft. by 100 ft.	$50 per front foot
4.	50 ft. by 100 ft.	$15 per front foot
5.	24 ft. by 100 ft.	$3 per square foot
6.	25 lots	$125 per lot
7.	150 lots	$250 per lot

Find the net proceeds of the sale of the following parcels of land:

	Parcel	*Selling Price of Land*	*Commission to Broker*
8.	*A*	$12,500	$312.50
9.	*B*	$375,000	$5625

Find the commissions earned by brokers on the following sales:

	Sales Price	*Rate of Commission*		*Sales Price*	*Rate of Commission*
10.	$750	5%	**12.**	$150,000	1½%
11.	$8000	2½%	**13.**	$1,600,000	1¼%

Find the gross cost to the buyers in the following sales:

	Price Paid	*Legal Fees*		*Price Paid*	*Legal Fees*
14.	$1250	$90	**15.**	$72,500	$275.25

Group 2

1. Mr. Girard desired to build a house in the business section of the town on a plot 40 ft. by 100 ft. If in that neighborhood a square foot is sold for $1.65, how much will Mr. Girard have to pay for the plot?

2. Mr. Henry Loring sold a plot of land 25 ft. by 100 ft. on Jefferson Street for $2750. The broker's rate of commission was 2½%. How much did Mr. Loring receive for the land?

3. Two city lots, each 40 ft. by 120 ft., were purchased by Mr. Scott at $30 a front foot. Legal fees amounted to $60; the title search cost $45; and other expenses were $5.75. What did the lots cost Mr. Scott?

4. Mr. Condon bought 5 plots measuring 40 ft. by 100 ft. for 75¢ a sq. ft. The legal fees amounted to $35. The title was searched and guaranteed for $75. How much did Mr. Condon spend for the land?

5. Mr. Brooks sold 20 lots at $1500 each. The brokerage fee was 2½%, and legal fees amounted to $75. (*a*) What was the net amount received for all the lots? (*b*) What was the selling price of the entire parcel per front foot, if each lot was 20 ft. by 100 ft.?

UNIT 2

Having a House Built

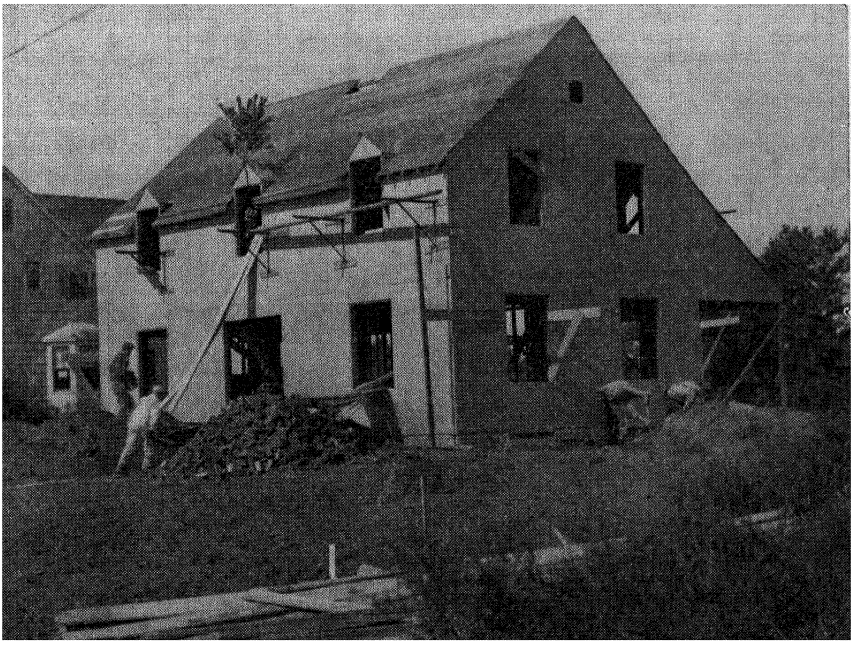
When the country was young, men built their own homes, either by themselves or with the help of neighbors. Homes were simple, and conveniences were few. Today, of course, that is no longer true. The man who wants his own home either buys it ready made or has it built for him by someone who is in business for that purpose. The job of building a home is no longer a one-man job, and expert workmanship is required. In this lesson we are primarily interested not in homes that are bought completely finished but in those that are built to order.

Definite Cost Price Versus Cost-Plus Basis

Two plans are usually open to the man who is having a home built for him according to his own specifications. He may tell a builder just what he wants and receive an *estimate* as to what the complete cost will be, or he may have it built on what is known as the *"cost-plus" basis.* The first method offers no difficulty, since the price is already known, but the second does require calculation. Under that method the builder supplies an estimate, but the ultimate price is indefinite. At the end of the job, when the home is finished, the builder submits a list of all the costs of building, including such items as excavating, masonry, carpentry, plastering, roofing, and electrical work, and, after totaling them all, takes an agreed percentage of the total cost, which he then adds to the bill. This additional percentage is to compensate him for all the work he did in directing the construction of the house.

Cost of Building a Home on the Cost-Plus Basis

EXAMPLE. A building contractor agrees to build a home for a client on the basis of cost plus 10%. After the home is completed, the following



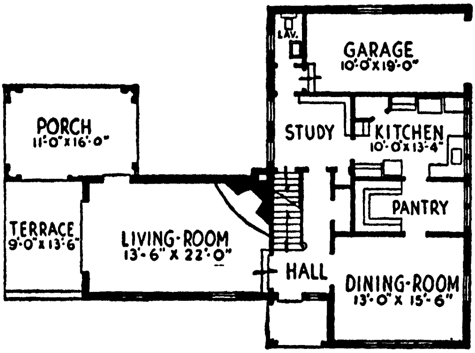
A House Under Construction. Buying a home is a large investment. How a house is constructed should be checked by the prospective buyer.

items of expense, including labor, are listed: Excavating, $650; masonry, $750; carpentry and millwork, $5750; plastering, painting, papering, and finishing, $1700; roofing, $600; plumbing and heating, $1650; electrical wiring and fixtures, $450; other work, such as linoleum, tiling, landscaping, and so forth, $875. What is the total cost to the buyer?

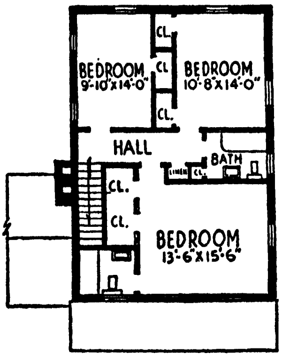
House Plans

Before construction is actually begun, a plan of the house, showing all the rooms to be built, the dimensions of each, and the arrangement, is prepared. Such drawings are known as *house plans*, or *blueprints*, and are made by draughtsmen from forms prepared by an architect. A sample of such a house plan is shown below.

FIRST FLOOR



SECOND FLOOR



Read the plan given above and answer these questions: How many rooms are there on the first floor? Name them. What are the dimensions of each? How many rooms are there on the second floor? Name them. Explain the arrangement of rooms on each floor. How many doors and windows are there in the living room?

Now let us proceed with the solution of our problem.

SOLUTION.

Excavating	$ 650	
Masonry	750	
Carpentry and millwork	5750	
Plastering and painting	1700	
Roofing	600	
Plumbing and heating	1650	
Electrical work	450	
Other work	875	
	$12,425.00	total cost of material and labor.
Plus 10% builder's fee	1242.50	
	$13,667.50	total cost to buyer.

Problems

GROUP 1

Find the total cost of each of the following homes:

	Land	*Materials and Labor*	*Builder's Fee*
1.	$5000	$8000	10%
2.	$2000	$6000	8%
3.	$9000	$15,000	5%
4.	$6000	$9000	7%
5.	$20,000	$25,000	6%

Find the areas of the following rooms in a newly built house:

6. Living Room, 12 ft. by 20 ft.
7. Dining Alcove, 8 ft. 6 in. by 7 ft.
8. Porch, 12 ft. by 12 ft. 6 in.
9. Bedroom, 11 ft. by 12 ft.

GROUP 2

1. The Spear Construction Company agreed to build a ranch-type house for Mr. Gates on the basis of cost plus 8%. Materials cost $6000 and labor amounted to $6750. In addition, Mr. Gates paid the Spear Construction Company $1225 to finish the cellar. How much did Mr. Gates pay for the house?

2. Mr. Andrews purchased a plot of land for $1700. He desired to build a Spanish-type house. The plans for the house were drawn by an architect, who charged $210. Materials and labor were estimated to cost $7990. A contractor was to receive 8% of the cost. What will the house and lot cost Mr. Andrews?

3. Mr. Marsh owns a plot of land and wishes to build a house on it. Plans for the house were drawn by an architect for $250. A contractor agrees to build the house for the cost plus 9%. He estimates that the labor will amount to $5225 and materials will amount to $6750. A garage and driveway will cost $485. How much will Mr. Marsh pay for the house?

4. The Charter Building Company agrees to build a house for Mr. Cole on the basis of cost plus 9%. Costs are estimated as follows: Excavating, $675; masonry, $650; plastering and painting, $1625; lumber and carpentry, $6275; plumbing and heating, $1850; electrical wiring and fixtures, $775; and other miscellaneous expenses, $380. What will the house cost Mr. Cole?

5. Mr. Peter Long contracted with the Georgian Building Company to build a house for him for the cost plus 10%. The estimated costs were as follows: Electrical fixtures and wiring, $750; landscaping, $850; excavating, $400; painting and plastering, $1800; masonry, $900; roofing, $1250; plumbing and heating, $2800; carpentry and lumber, $7500. How much will the house cost Mr. Long?

UNIT 3

Financing the Purchase of a Home

SOMETIME or other the urge comes to most of us to have a home of our own. Usually, however, people do not have enough cash to pay for a home all at once. Therefore, to help such prospective buyers to become homeowners, banks lend them the necessary funds, receiving a *mortgage* on the property. A mortgage is usually paid off with interest by regular payments over a period of years, until, when all payments have been made, the buyer finally owns his home free and clear. Sometimes the mortgage may be of the type that is not paid off until a final due date, the borrower merely paying the interest on the sum he received, but, in the purchase of homes, the first practice mentioned is the more usual one.

Monthly Payments on Mortgage Plus Interest on Unpaid Principal

EXAMPLE. On May 1 Arthur Daley buys a home for $6250, paying 20% of the cost in cash and obtaining the rest on a mortgage from a savings bank. This loan is to be paid back in regular monthly installments of $50 plus interest of 6% on the unpaid balance, the contract also providing that the full amount due can be paid on the first of any month if the borrower so wishes. (*a*) Find the amount borrowed from the savings bank. (*b*) Find the amount Mr. Daley must pay each month from June 1 to Aug. 1. (*c*) Find the amount left unpaid on the mortgage after the Aug. 1 payment is made.

SOLUTION.

(*a*) 20% of $6250 = $1250, down payment.
$6250 − $1250 = $5000, amount of mortgage.

(*b*)

Interest on $5000 for 1 mo. at 6%	$25
Plus payment on principal	$50
	$75, amount of payment on June 1.

$5000 − $50 = $4950, balance due on July 1.

Interest on $4950 for 1 mo. at 6%	$24.75
Plus payment on principal	$50.00
	$74.75, amount of payment on July 1.

$4950 − $50 = $4900, balance due on Aug. 1.

Interest on $4900 for 1 mo. at 6%	$24.50
Plus payment on principal	$50.00
	$74.50, amount of payment on Aug. 1.

(*c*) $50 × 3 = $150, total of June 1, July 1, and Aug. 1 payments.
$5000 − $150 = $4850, amount left unpaid after Aug. 1 payment.

You will notice that the monthly payment is not deducted in full from the unpaid balance. All that is deducted is $50, because the balance of the payment is the interest.

Fixed-Mortgage Plan

Under the fixed-mortgage plan, the borrower generally pays interest to the bank or other mortgagee twice a year, making no payments on the principal. Then, when the mortgage becomes due, the entire sum is payable at once.

EXAMPLE. A buyer of a home borrows $5000 from a bank under a mortgage, agreeing to pay 5% interest semiannually, the mortgage to fall due in 20 yr. How much interest is due every 6 mo.? How much is due on the mortgage at the end of 20 yr.?

SOLUTION.

Interest on $5000 for 6 mo. at 5% = $125, amount of semiannual payment.
Amount due at the end of 20 yr. is the same as amount of mortgage, or $5000.

Problems

1. Mr. Keys buys a home for $9500. He pays 25% down and obtains the balance from a savings and loan association. He agrees to pay $60 a month with interest at 6%. (*a*) What does he owe on the principal at the end of six months? (*b*) How much interest has he paid during the first six months?

2. Mr. John Martin has $2500 in cash, which he pays as a down payment on a $10,000 house. He borrows the balance from a bank at $5\frac{1}{2}$% interest. He agrees to pay $65 a month with interest. Find his total payments of principal and interest for the first twelve months.

3. A home is purchased by Mr. Ramsey for $14,000. He pays 20% down. The balance he borrows from a mortgage finance company. He agrees to pay $800 a year in quarterly payments with interest at 6%. What are his first four payments?

4. Mr. Harlow owes $9000 on a 5% mortgage. The mortgage requires a semiannual payment of interest and $600 on the principal. How much will Mr. Harlow have paid by the end of the first year?

5. Mr. Martin bought a house and lot for $7990. He paid 20% of the cost in cash and obtained a mortgage from a savings bank for the balance. The loan was to be paid back in monthly installments of $65, with interest at 6% on the unpaid balance. How much must be paid to the bank at the end of the third month?

Federal Housing Administration-Insured Mortgages

The F. H. A. does not loan money. It merely insures loans made by banks, savings and loan associations, mortgage companies, insurance companies, and other financial houses approved by the F. H. A. This protection enables these institutions to make mortgage loans on desirable terms with small down payments and low interest rates. The interest rate cannot be more than 5% plus ½ of 1% for the F. H. A. insurance premium.

In addition to small down payments and low interest rates, other advantages are: (1) the repayment in equal monthly installments, about like rent; (2) inclusion of taxes, interest, and insurance in the monthly payments; and (3) elimination of second mortgages and the need for expensive refinancing.

PARTIAL TABLE OF F. H. A. LOANS

(Showing monthly installments necessary to pay off a loan in equal payments)

Term of Loan	*No. of Payments*	*Monthly Installment* per $1000 *Including Principal, Interest, and F. H. A. Insurance*	
		At 4¾%	*At 5%*
12 years	144	$9.13	$9.25
15 years	180	7.78	7.91
18 years	216	6.90	7.04
20 years	240	6.47	6.60
25 years	300	5.71	5.85

On the assumption that the minimum amount of down payments required on new homes is:

Appraisal not over $6650..........	10%
Appraisal not over $9450..........	10% of first $7000 plus 35% of remainder
Appraisal over $9450..............	25%
Any amount on existing homes.....	25%

EXAMPLE.

Appraised value of property................		$8500.00
10% of first $7000.00..........	$700.00	
35% of balance...............	525.00	
Total down payment......................		1225.00
F. H. A. mortgage......................		$7275.00

EXAMPLE. Mr. Barkley built a new house which was appraised at $14,500. He applies for an F. H. A. loan for 18 years at 4¾%. His property tax is $264 for a year, and fire and tornado insurance is $18 a year. (*a*) What is the amount of his mortgage? (*b*) What will be the total amount of his monthly payments?

SOLUTION.

25% of $14,500 = $3,625
$14,500 − $3,625 = $10,875, Amount of mortgage

Referring to the table,
Monthly installment payment = $ 6.90 per thousand
$6.90 × 10.875 = $75.04, principal, interest, F. H. A. insurance
$264 ÷ 12 = 22.00, taxes
$18 ÷ 12 = 1.50, insurance
Total monthly payment = $98.54

Problems

1. What will be the minimum down payment on new homes with the following appraisals: (*a*) $6000; (*b*) $7500; (*c*) $8500; (*d*) $16,000?

2. Mr. Davis buys a small bungalow appraised at $6500. He wishes to make the minimum down payment and pay for the balance in 12 years. His taxes average $125 a year and his fire insurance is $36 every three years. Interest on the loan is 4½% and F. H. A. insurance is ½ of 1%. Find his monthly F. H. A. payments.

3. If Mr. Harrison borrows $8000 under an F. H. A. loan for 25 years, what will he pay in interest at 4¼% and F. H. A. insurance at ½ of 1% during the 25 years?

4. Mr. Farnum buys a new ranch-type house appraised at $18,000. He makes the minimum down payment. The combined interest and F. H. A. insurance on his loan is 4¾%. The loan is to be paid off in 20 years. What will be his monthly payments if his taxes average $480 a year and his insurance $60 a year?

5. Mr. Keyes must borrow $8000 to complete the purchase of his new home. He cannot decide whether to take 15 years or 20 years to complete his payments. How much more in interest and F. H. A. insurance at 5% would the 20-year plan cost him?

UNIT 4

Finding the Maintenance Cost of Owning a Home

WHEN the question of buying a home for one's own use arises, in preference to renting an apartment, several problems enter into the deliberation. The prospective homeowner will probably ask himself these questions: What are the advantages and disadvantages of each? What is the relative cost of a home and an apartment, and how may they be calculated? Is a one-family or a two-family house better? Let us examine each question separately.

Advantages and Disadvantages of Owning One's Own Home

The advantages of owning one's own private home may be summarized briefly as follows: (1) More room at less cost. (2) Greater opportunity for children to play. (3) More security. (4) Permanency.

The disadvantages of owning a home may be summarized as follows: (1) Responsibility for supplying heat and hot water. (2) Responsibility for making repairs. (3) Less chance of being able to move to a more modern home or more desirable neighborhood. (4) Possibility of loss of home and payments made on it through default on mortgage.

Costs on a One-Family House

Example. Mr. Powell earns $3600 a year and is paying $75 monthly rent for a city apartment. He wishes to move to the suburbs, where he can buy a house and lot for $7500, paying $2000 down and borrowing the $5500 balance required on a 6% mortgage due in 5 years. (*a*) If he must pay real estate taxes of $120, a water tax of $15, and insurance premiums of $35 a year, how much will it cost him per month, exclusive of heating and repairs, to own the house, allowing 4% interest on his investment of $2000 and 2% depreciation on the building, which is valued at $5000? (*b*) If the average annual cost of heating and repairs is $175, would the cost of owning this home be more or less per month than the rent he pays for his apartment?

Solution.

(*a*)	Interest on mortgage—6% of $5500	$330
	Real estate taxes	120
	Water tax	15
	Fire insurance	35
	Depreciation allowance—2% of $5000	100
	Interest on investment—4% of $2000	80
		$680, cost (exclusive of heating and repairs) per year.

$680 ÷ 12 = $56.67, cost (exclusive of heating and repairs) per month.

(*b*) Annual fixed charges......	$680
Plus average annual cost of heating and repairs......	175
	$855, total maintenance cost per year.

$855 ÷ 12 = $71.25, total maintenance cost per month.

$75 − $71.25 = $3.75, saving in cost of home over cost of apartment.

Maintenance Cost on a Two-Family House

Example. Mr. Powell finds that he can buy a two-family house for $10,500. The broker estimates that the yearly costs will be as follows: Taxes, $285; insurance, $60; heating, $180; interest on mortgage, $390; painting, repairs, and so forth, $300. If Mr. Powell lives in one apartment and rents the other for $60 per month, what will it cost him monthly to own the house? (Allow interest at 4% on an investment of $4000 and 2½% depreciation on the building, which is valued at $7500.)

Solution.

Real estate taxes.....................	$ 285.00
Insurance...........................	60.00
Heating............................	180.00
Interest on mortgage—6% of $6500....	390.00
Miscellaneous expenses..............	300.00
Depreciation allowance—2½% of $7500.	187.50
Interest on investment—4% of $4000...	160.00
	$1562.50, total annual cost.
Less income from rented apartment ($60 a month for 12 mo.)...............	$ 720.00
	$ 842.50, net cost for year.

$842.50 ÷ 12 = $70.208, or $70.21, average monthly cost.

Problems

Group 1

Find the monthly costs of maintaining homes with the following annual expenses:

	Real Estate Taxes	*Insurance*	*Interest on Mortgage*	*Depreciation*	*Interest on Investment*	*Water*	*Other Expenses*
1.	$175	$25	$300	$100	$70	$20	$30
2.	$200	$30	$450	$150	$170	$25	$65
3.	$150	$25	$375	$125	$225	$15	$45
4.	$225	$35	$425	$200	$115	$25	$65
5.	$200	$20	$300	$100	$80	$20	$30

Find the monthly cost of the owner's apartment for the following two-family houses:

	Estimated Annual Maintenance Cost	*Income from Other Apartment*		*Estimated Annual Maintenance Cost*	*Income from Other Apartment*
6.	$1500	$780	**8.**	$1320	$720
7.	$1080	$600	**9.**	$1260	$540

Group 2

1. Mr. Ralston earns $2500 a year and is paying $50 a month rent for an apartment. He desires to buy a house for $6950, paying $2000 in cash and borrowing the balance on a 5% mortgage due in 10 years. His estimated annual expenses will be as follows: Insurance, $59; water tax, $12; real estate taxes, $90; coal used for heating, $85; repairing and glazing, $25. He figures that he should allow 3% for depreciation on the house, which is valued at $6000, and 4% interest on his investment. How much more or less than his present rent would the cost of owning this home be?

2. Mr. Spear, a druggist, desires to purchase a building for $28,000 with a $6000 down payment. At present he is paying $210 a month rent for a store. The annual expenses are as follows: Insurance, $175; water tax, $100; coal, $525; taxes, $325; repairs, $325; allowance for depreciation, $300; interest on mortgage, 4½%. Mr. Spear considers that his money is worth 6% to him in his business. Would it be cheaper to buy the building or to continue to rent the store? How much would be saved annually?

3. Mr. Kane owns a two-family house which he bought for $12,000, paying $5000 cash and giving a 5% mortgage for $7000. Mr. Kane occupies one floor and rents the other for $75 a month. His annual expenses are as follows: Taxes, $225; insurance, $75; oil used for heating, $145; repairs, $75; depreciation on building, valued at $10,000, 2%; and interest on investment, 3½%. What is Mr. Kane's monthly cost for his apartment?

4. A man can rent a one-family house for $600 per year. He can buy the building and the lot upon which it stands for $7500 with a $3000 down payment. The taxes are $212; insurance is $37; depreciation allowance is $150; and repairs and other expenses are $375 per year. If his money is worth 5% to him and the mortgage rate is 4½%, would it be better for him to buy the home or to rent it? How much better per month?

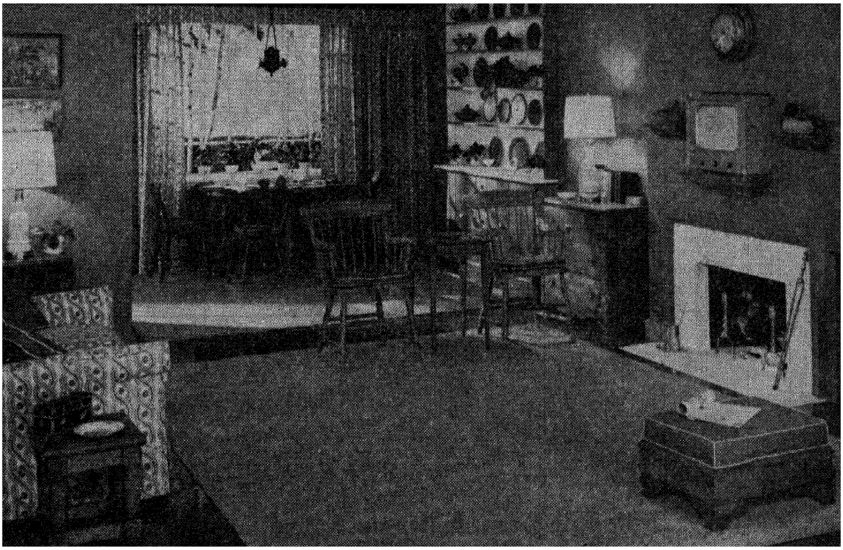
5. Mr. Stanton can buy a two-family house for $13,000 or a four-family house for $20,000. He would pay $5000 down in either case. On the two-family house the annual income is $600, and the expenses are as follows: Taxes, \$215; insurance, \$60; oil for heating, \$130; repairs, \$80; depreciation of building, 2% on \$10,000; interest on investment, 3%, and on mortgage, 5%. On the four-family house the annual income is \$1900, and the expenses are as follows: Taxes, \$425; insurance, \$95; coal, \$220; repairs, \$320; depreciation of building, 2% on \$15,000; interest on investment, 3%, and on mortgage, 5%. What would Mr. Stanton's rent be in each case?

UNIT 5

Computing Area

In computing the cost of painting a house both inside and outside, paper hanging, carpeting, cementing floors, and similar jobs, it is necessary to find the area of the space or spaces. As room dimensions are usually given in feet, the costs are figured either in square feet or in square yards.

The areas of a room consist of three pairs of equal rectangles—the floor and ceiling, two sides, and two ends, unless the room is square, in which case all sides are equal. The area of the four sides is called the *lateral area.* The lateral area, plus the floor and ceiling, is called the total area.



Courtesy of Glidden Company

Interior of a Modern Home. Maintaining a home requires many expenditures within the house, such as carpets and rugs, paint, draperies, furniture, and decorations.

Example 1. A room is 15 feet long, 12 feet wide, and 9 feet high. What is the lateral area?

Solution.

$15' \times 9' \times 2 = 270$ sq. ft., area of the two sides
$12' \times 9' \times 2 = \underline{216}$ sq. ft., area of the two ends
486 sq. ft., lateral area

A simpler method of finding the lateral area is that of multiplying the perimeter by the height.

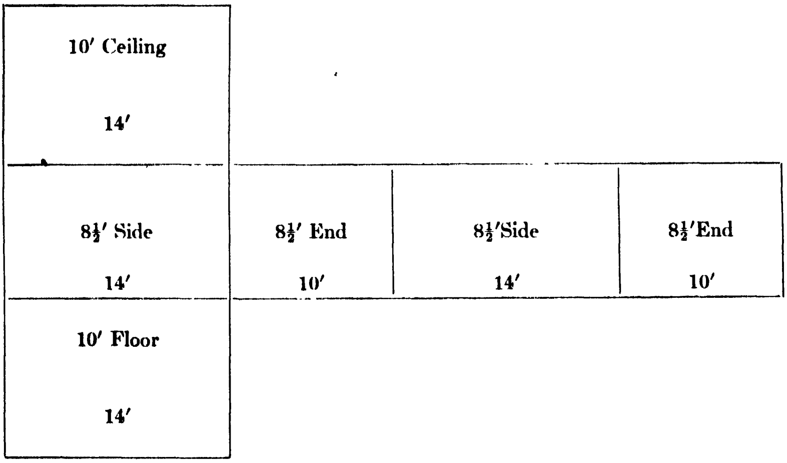
$15' + 15' + 12' + 12' = 54$ ft., perimeter
$54' \times 9' = 486$ sq. ft., lateral area

Note that in giving the dimensions of a room, length is given first, width second, and height third.

Example 2. Find the total area of a room $14' \times 10' \times 8\frac{1}{2}'$.

Solution.

$14' + 14' + 10' + 10' = 48'$, perimeter of room
$48' \times 8\frac{1}{2}' = 408$ sq. ft., lateral area
$14' \times 10' = 140$ sq. ft., area of ceiling
$14' \times 10' = \underline{140}$ sq. ft., area of floor
688 sq. ft., total area



Exercise. Draw a diagram similar to the one shown above. Use the same dimensions. Draw to scale of $\frac{1}{4}''$ to $1'$. Cut out and fold. Notice that the part of the diagram representing the sides is the same as one rectangle $48' \times 8\frac{1}{2}'$.

Problems

1. Find the area in square feet of a lot 50′ × 150′.
2. What is the lateral area of a room 16′ × 12′ × 8′?
3. What is the total area of a room 20′ × 14′ × 12′?
4. How many square yards of surface are in the walls and ceiling of a room 15′ × 12′ × 9′?
5. What is the lateral area of a garage 20′ × 14′ × 10′?

UNIT 6

The Cost of Painting

Example. What is the cost of painting the walls and ceiling of a room 14′ × 12′ × $8\frac{1}{2}$′ if one gallon of paint covers 400 sq. ft. and costs \$4.50 a gallon?

Solution.

$$14' + 14' + 12' + 12' = 52', \text{ perimeter of room}$$

$$\begin{aligned} 52' \times 8\tfrac{1}{2}' &= 442 \text{ sq. ft., lateral area} \\ 14' \times 12' &= \underline{168} \text{ sq. ft., area of ceiling} \\ & 610 \text{ sq. ft., total area} \end{aligned}$$

$$\frac{610}{400} \times \$4.50 = \$6.86, \text{ Cost of paint.}$$

Problems

1. What will it cost to paint the walls and ceiling of a room 15′ × 12′ × 9′ at 5¢ a square foot?

2. Find the cost, at 35¢ per square yard, of painting the walls and ceiling of a room 18′ × 16′ × 8′.

3. Find the cost of painting the outside of a building 60 feet long, 50 feet wide, and 21 feet high. It is estimated that for the first coat 1 gallon of paint will cover 420 square feet of surface, and that for the second coat 1 gallon will cover 770 square feet. The paint costs \$4.50 a gallon.

4. What will it cost, at $27\frac{1}{2}$¢ a square yard, to paint the sides of a barn 72 ft. long, 36 ft. wide, and 18 ft. high?

5. Determine the number of square feet of painted surface in your classroom. Deduct for windows, doors, and blackboards. What will be the total cost for one coat if the paint is worth \$4.75 a gallon and one gallon covers 450 square feet of surface?

UNIT 7

The Cost of Papering

EXAMPLE. Find the cost of papering two rooms both of which are $14' \times 10' \times 8\frac{1}{2}'$ at \$2.80 per double roll for paper and \$1.30 per single roll for hanging the paper. Allow for two windows 3 ft. by 6 ft. and one door 3 ft. by 7 ft. in each room.

Most American wallpaper has 24 ft. in a single roll, or 48 ft. in a double roll, and is 18 in. wide. Imported papers vary both in length and in width. Paperhangers charge by the roll or by the day for hanging paper. When the charge is made by the roll, the price is based on a single roll of 24 ft.

SOLUTION.

14 ft. + 10 ft. + 14 ft. + 10 ft. = 48 ft., perimeter of each room.
3 ft. × 3 = 9 ft., width of openings in each room.
48 ft. − 9 ft. = 39 ft., net perimeter of each room.
39 ft. ÷ $1\frac{1}{2}$ ft. = 26, number of strips required for each room.
48 ft. ÷ $8\frac{3}{4}$ ft. = 5.49, number of $8\frac{3}{4}$-ft. strips in 1 double roll.
26 ÷ 5.49 = 4.7, or 5, number of double rolls required for each room.
2 × 5 = 10, number of double rolls required for both rooms.
10 × \$2.80 = \$28, cost of paper.
10 double rolls = 20 single rolls.
20 × \$1.30 = \$26, cost of hanging paper.
\$28 + \$26 = \$54, total cost of papering both rooms.

You should observe that, in papering a room, only the straight surfaces of the walls are covered. The ceiling, doors, and window frames have to be painted. You must know the cost of papering and painting (the parts not papered) to arrive at the total cost of a papering job.

Problems

1. Find the number of double rolls of wallpaper needed for a room $12' \times 10' \times 8'$.

2. Find the number of single rolls of wallpaper needed for a room $15' \times 12' \times 8'$.

3. Find the cost of the paper, at \$3.60 per double roll, which is needed for a room 24 ft. long, 20 ft. wide, and $8\frac{1}{2}$ ft. high, allowing for four win-

dows 3 ft. 6 in. wide and two doors 4 ft. wide. Base your calculations on the whole number of strips from a roll.

4. Find the cost of papering a room 20 ft. long, 16 ft. wide, and 8 ft. high, at $1.80 per double roll for the paper and $1.10 per single roll for hanging the paper. Allow for three windows 3 ft. wide and one door 4 ft. wide.

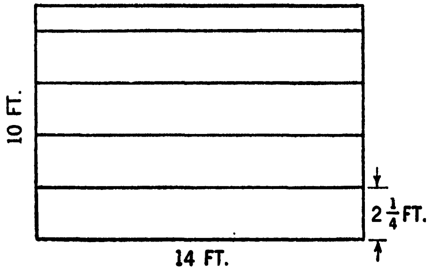
5. Find the cost of papering three rooms 15 ft. long, 12 ft. wide, and 8 ft. high, at $1.20 per single roll for the paper and $1.25 per single roll for hanging the paper. Allow for two windows 3 ft. wide and one door 4 ft. wide in each room.

UNIT 8

The Cost of Carpeting

Example. Find the cost, at $2.50 per yard, of carpet for two rooms 14′ × 10′. The strips are to run lengthwise.

Carpet varies in width. Inexpensive grades are usually 36 in. wide, and the better grades are usually 27 in. wide.



While carpet may be purchased in any length desired, only whole strips can, as a rule, be purchased. In the case of a figured carpet, allowance has to be made for matching the pattern.

Solution.

27 in. = $2\frac{1}{4}$ ft.

10 ft. ÷ $2\frac{1}{4}$ ft. = $4\frac{4}{9}$, or 5, number of strips required for each room.

2 × 5 = 10, number of strips required for both rooms.

$\frac{14 \times 10}{3} = 46\frac{2}{3}$, or 47, number of yards of carpet required.

47 × $2.50 = $117.50, cost of carpet.

Problems

1. Find the cost of carpet for a bedroom, size 12′ 6″ × 10′ 6″, if the carpet is 36 inches in width and costs $3.75 per yard.

2. What is the cost of the carpet for a living room 15′ × 12′ if the carpet is 27 inches wide and costs $5.25 a yard?

3. What is the cost of carpeting 14 steps at $3.50 per yard, if each step is 9½″ wide and the rise is 7½″?

4. Find the total cost of carpeting a living room 16′ × 10½′ and a dining room 12′ 6″ × 10′ 6″ with 27-inch carpet at $5.00 a yard. Strips are to run lengthwise.

5. Find the cost of the above two rooms if the strips are laid across the room.

Miscellaneous Problems

1. Find the cost, at 65¢ per square foot, of a cement walk 3 ft. wide laid on the outside of two sides of a corner lot 125 ft. long and 40 ft. wide.

2. Find the cost, at 45¢ per square foot, of a cement walk 4 ft. wide around a city block 800 ft. long and 250 ft. wide. (The measurements given are the inside measurements of the walk.)

3. How much will it cost, at $3.80 per square yard, to build a cement walk 4 ft. wide on the outside of a corner lot 25 ft. by 100 ft.?

4. At $1.20 per square yard, find the cost of plastering the walls and ceiling of a room 18′ × 16′ × 9′.

5. Find the cost at $1.10 per square yard of plastering the walls and ceiling of a room 22′ 6″ long, 18′ 6″ wide, and 9′ high, allowing one-sixth of the total surface for doors and windows.

6. What is the cost of covering the walls of a kitchen 10′ × 6′ × 8′ with tile board at 30¢ a square foot?

7. Find the cost of covering a kitchen floor, size 12′ × 10′, with linoleum at $1.20 per square yard.

8. What is the cost of covering a kitchen floor, 9 ft. long and 11 ft. wide, with tile blocks 6″ × 6″ at 9¢ each?

9. What is the cost of covering a garage roof which is 20′ × 16′ with asphalt roofing at 3½¢ per square foot?

10. How many sheets of insulation board, size 4′ × 4′, will it take to cover the sides and ceiling of a room 14′ × 10′ × 8′?

Chapter Test—Review

1. What is the price of a lot 40 ft. by 120 ft. at $.50 per square foot?

2. A lot 50 ft. by 150 ft. was sold for $45 a front foot. The brokerage fee was 1½%. What was the selling price of the lot?

3. A contractor agrees to build a house for Mr. Miller for the cost

plus 10%. The lot cost $2200 and material and labor amounted to $11,450. What will the house cost Mr. Miller?

4. Mr. Perry purchases a home for $12,500. He pays 20% down and borrows the balance from a savings and loan association. He agrees to pay $60 a month with interest at 6%. (*a*) What does he owe on the principal at the end of three months? (*b*) How much interest has he paid during this time?

5. Mr. Starrett buys a home for $13,000. He pays 25% down and borrows the remainder from a mortgage finance company. He agrees to pay $800 a year in quarterly payments with interest at 4%. What are his first four payments, including interest?

6. Mr. Noble pays $14,500 for a home. He pays 25% down and borrows the balance under an F. H. A. plan. Payment on the principal, interest, and F. H. A. insurance amounts to $6.60 per month per thousand dollars. His taxes are $360 a year and fire insurance $24 a year. If his loan runs for 18 years, what will be the total cost of the house to Mr. Noble?

7. Mr. Hunt is paying $75.00 a month for his apartment. He has $2000 cash for a down payment on a house priced at $8000. He can borrow the balance at 5%. His taxes will be $68 a half-year, insurance $20 a year, water $15 a year, depreciation allowance 3% of $5000, and interest on investment 4% of $2000. Exclusive of heating and repairs, how much will he save a month by owning his own home?

8. What will it cost to paint the walls and ceiling of a room 14′ × 11′ × $8\frac{1}{2}$′ at 30¢ per square yard?

9. Find the cost of painting the outside of a building 26′ × 24′ on its foundation and 22′ high. It is to be given two coats of paint bought at $4.75 a gallon. A gallon will cover approximately 400 square feet of surface.

10. Find the cost of papering a room 12′ × 10′ × 8′ with wallpaper at $2.50 per double roll and $1.25 per single roll for hanging the paper. Allow for one window 3 ft. wide and one door 4 ft. wide.

11. What is the cost of covering a kitchen 12′ × 8′ with linoleum at $1.60 per square yard?

12. What is the cost of carpeting a room 16′ × 12′ if the carpet is 27 in. wide and costs $6.50 a yard?

Speed Drills in Fundamentals

Test 6

Add:

1.	**2.**	**3.**	**4.**
$412.29	$132.66	$ 67.74	$638.76
278.67	468.21	318.57	83.84
63.80	93.69	26.84	41.95
389.58	239.70	647.58	598.12
68.83	89.83	299.87	297.47
87.92	28.76	57.96	59.81
85.97	567.64	448.98	1872.35
46.45	87.79	582.69	749.91
354.62	395.89	55.63	348.21
13.84	78.83	77.47	562.50

Subtract:

5.	**6.**	**7.**
54.384	8.3520	$64\frac{5}{8}$
23.595	.3658	$6\frac{1}{3}$

Fill in the required number of days:

8.	**9.**	**10.**	**11.**
14 da.	9 da.	25 da.	16 da.
31 da.	28 da.	31 da.	30 da.
30 da.	31 da.	28 da.	31 da.
da.	da.	31 da.	31 da.
90 da.	85 da.	da.	da.
		126 da.	120 da.

12–14. *Find the balances:*

	Ryan's Account	*Jackson's Account*	*Moore's Account*
Balance, June 1..........	$673.00	$1472.30	$1734.64
Check Number 1......	26.50	284.45	185.25
Balance................			
Check Number 2......	67.75	318.57	93.86
Balance................			
Check Number 3......	19.80	62.94	367.38
Balance................			

Multiply:

15. $14\frac{1}{8} \times 21\frac{1}{2}$

16. $56\frac{3}{4} \times 15\frac{1}{2}$

17. $69\frac{3}{5} \times 15\frac{1}{2}$

18. 225 × $.05

19. 300 × $.045

20. 7560 × $.0375

Perform the indicated operations:

21. $725.28 ÷ 100 × ½

22. $725.28 ÷ 100 × ⅓

23. $725.28 ÷ 100 × ¼

24. $725.28 ÷ 100 × ⅙

Divide:

25. 138,714 ÷ 758

26. 35,697 ÷ 12.83

27. 39⅓ ÷ 3⅗

28. 85 ÷ 175%

29. $4500 ÷ 8⁄7

30. $3 ÷ $7½

Solve:

31. 6% of $250

32. ½% of $1200

33. 33⅓% of $24

34. .2% of $75

35. 45% of $1850

Find the interest at 6%:

36. $400 – 60 da.

37. $300 – 30 da.

38. $1200 – 45 da.

39. $100 – 90 da.

40. $600 – 15 da.

How many articles can be bought for:

41. $120 at 33⅓¢ each?

42. $72 at 12½¢ each?

43. $48 at 16⅔¢ each?

44. $60 at 75¢ each?

45. $75 at 83⅓¢ each?

Change to per cents:

46. ¼

47. .375

48. 5

49. .0025

50. 3⁄10

Chapter 11

Fire Insurance

UNIT 1

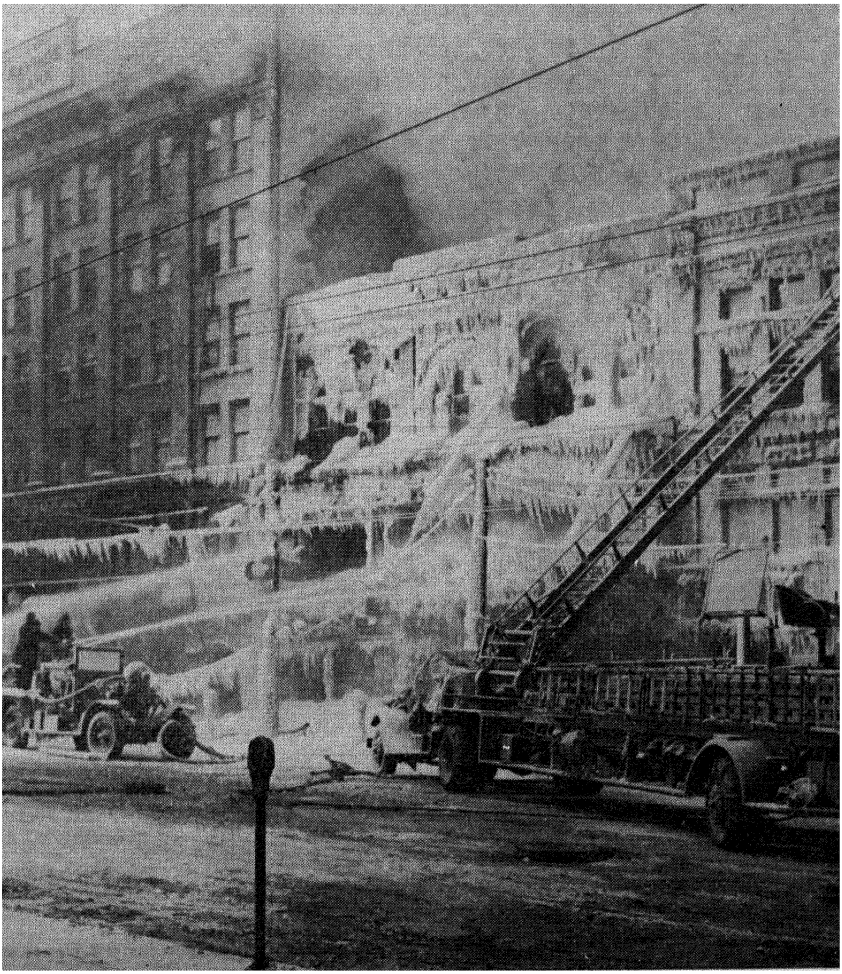
Cost of Fire Insurance

Nature and Meaning of Insurance

Charles Clark wishes to protect himself against losses that may arise out of destruction of his property—the building and its contents. He knows that, if he buys insurance, he will not stand the money loss himself, since the insurance company will pay for any damage resulting from fire. The insurance company is in a position to pay the loss because it collects in advance small amounts in premiums not only from Charles Clark, but also from hundreds and even thousands of other persons who buy protection. Of course, the insurance company does not use all the money it collects from premiums to pay fire losses. Like any other business, it uses part of its income to pay operating expenses, such as agency expenses, brokers' commissions, and general expenses.

Terms Used in Fire Insurance

In order to understand a discussion of insurance, we must know the meanings of the following terms: *Insurer, insured, broker, annual premium rate, premium, policy, face of policy, fire hazard, risk,* and *term of policy.* The insurance company which sells the protection is known as the *insurer* or *underwriter,* and the property owner—in this case, Charles Clark—is known as the *insured.* The agent who represents the insurance company as salesman, and sometimes as claim adjuster, is referred to as the *broker.* The charge for a certain amount of insurance is the *premium rate,* and the fixed sum of money that is paid to the insurance company for protection against loss is called the *premium*. The written agreement between the insured person and the insurance company is the *policy*. The amount of protection given by the company is the *face* of the policy. The *term* of the policy is the length of time for which it is in force. The *fire hazard*, or *risk*, means the likelihood that the property may burn, with the available means of protection taken into consideration.



A Fire in the Business District. Fire losses cost property owners hundreds of millions of dollars each year.

Insurance Cost for One Year

Example. What will Charles Clark have to pay a year to insure his brick dwelling, which cost $15,000, and his household furniture, which is valued at $6250, if both are insured for four-fifths of their value at the rates of 10¢ per $100 per year and 16¢ per $100 per year, respectively?

Solution.

$\frac{4}{5}$ of $15,000 = $12,000, amount of policy on building.
12,000 = 120 hundreds
120 × $.10 = $12, annual premium on building.
$\frac{4}{5}$ of $6250 = $5000, amount of policy on contents.
5000 = 50 hundreds
50 × $.16 = $8, annual premium on contents.
$12 + $8 = $20, total insurance cost for year.

Proof. $.10 per $100 = $.001 per $1
$12,000 × $.001 = $12
$.16 per $100 = $1.60 per $1000
5 × $1.60 = $8
$12 + $8 = $20

Problems

PREMIUMS FOR ONE-YEAR POLICIES

Complete the table:

Face of Policy	*Premium Rate*	*Premium*	*Face of Policy*	*Premium Rate*	*Premium*
1. $6500	$.11		6. $ 7500	$.28	
2. 4500	.17		7. 10,000	.34	
3 8000	.15		8. 12,000	.32	
4. 8500	.21		9. 12,500	.26	
5. 5000	.23		10. 11,000	.30	

Note: The premium rate given is always the cost per $100 of insurance.

Insurance Cost for a Term Longer Than One Year

We note from our premium table that rates are given in cents per $100 of value of property not only for 1 year but also for 3 years. We also see that the 3-year rates are cheaper per year than the 1-year rates. Insurance for 2 years, 4 years, and 5 years is also written for building property and the contents of dwellings. The schedule, you observe, does not include 3-year quotations on stocks of merchandise, because this kind of property can be insured for

1 year only. *The Insurance Producers Bulletin* has this to say about *term* insurance:

> On certain classes of business fire insurance may be written for a term longer than one year at 75% of the annual estimate for each additional year or pro-rata part thereof. The term rate works out as follows:
>
> 2 years: 1¾ Times the annual estimate
> 3 years: 2½ Times the annual estimate
> 4 years: 3¼ Times the annual estimate
> 5 years: 4 Times the annual estimate

EXAMPLE. If Charles Clark had insured the contents of his new house for four-fifths of their value for a period of 3 years, what would have been his premium?

SOLUTION.

The 3-yr. premium rate equivalent to the \$.16 yearly rate is \$.40, or exactly 2½ times the annual rate.

⅘ of \$6250 = \$5000, amount of policy.
5000 = 50 hundreds
\$.40 × 50 = \$20, premium for 3 yr.

Notice that by buying 3-year term insurance, Mr. Clark saves \$4 for the 3 years.

\$8 × 3 = \$24, premium for 3 yr. at 1-yr. rate.
\$24 − \$20 = \$4, saving.

Problems

GROUP 1

PREMIUMS FOR TERMS LONGER THAN ONE YEAR

Complete the table:

	Face of Policy	*Annual Premium Rate*	*Term of Policy in Years*	*Total Premium*
1.	\$ 4000	\$.26	2	\$
2.	12,000	.32	3	
3.	10,500	.28	4	
4.	6000	.38	5	
5.	7500	.25	3	
6.	12,500	.23	5	
7.	14,000	.31	4	
8.	11,000	.37	2	
9.	11,500	.17	3	
10.	8000	.29	3	

GROUP 2

PROPERTY INSURED FOR PART OF VALUE

Complete the table:

Class of Building	*Value of Property*	*Insured Part of Value*	*Annual Premium Rate*	*Term of Policy*	*Total Premium*
1. Brick dwelling.......	$ 8000	80%	$.26	3	$
2. Frame dwelling......	6000	80%	.30	3	
3. Apartment..	18,000	90%	.40	4	
4. Rooming house......	9000	$\frac{3}{4}$	.32	2	
5. Flat (two-family)....	12,500	$\frac{4}{5}$	.42	3	
6. Private boarding house	7500	80%	.38	5	
7. Nurses' home........	14,000	90%	.32	3	
8. Private garage.......	1000	$\frac{3}{4}$	.38	1	
9. Frame dwelling, unapproved roof........	6500	80%	.36	3	
10. Two-family..........	9500	80%	.32	3	

Short-Term Policies

Fire insurance policies may be written for periods of less than a year. Such policies are called *short-term policies.* When policies are canceled by the insured or the insurer, short-term rates also apply.

EXAMPLE. A. H. Smith, a receiver, insured a bankrupt stock of goods for $3000 for 8 months. What is the premium if the yearly rate is $3.20 per $100 and the premium for 8 months is 80% of the annual premium?

To find the premium for short-term policies, some insurance companies use short-rate cancellation tables, which indicate in a percentage the portion of the annual premium to be charged for a stated period of less than a year.

In writing short-term policies and in canceling at short rates either short-term or annual policies, insurance companies retain some percentage of the annual premium (in our problem, 80%). Also, the practice is to charge the annual premium and to allow a discount for periods less than 1 year.

SOLUTION.

$3.20 × 30 = $96, annual premium.
8 mo. premium = 80% of annnual premium
$96 × .80 = $76.80, premium for 8 mo.

For term policies in force for 1 year or more, parts of a month not exceeding 15 days may be disregarded; parts exceeding 15 days are to be counted as a full month.

Problems

Complete the table:

No.	*Value of Property*	*Insured for*	*Annual Premium Rate*	*Policy Canceled at End of*	*% of Annual Premium*	*Amount of Premium*
1.	$ 4500	Full Value	$.28	30 days	20	$
2.	6000	80%	.42	50 "	28	
3.	8500	$\frac{7}{8}$	.32	225 "	78	
4.	9500	$\frac{3}{4}$	.54	80 "	38	
5.	12,000	90%	.38	45 "	27	
6.	7000	$\frac{4}{5}$	.44	65 "	33	
7.	5500	Full Value	.36	80 "	38	
8.	11,500	80%	.52	60 "	30	
9.	8000	$\frac{3}{4}$	.26	20 "	17	
10.	9500	80%	.42	300 "	90	

UNIT 2

Collecting on a Fire Loss

LET US CONSIDER two stores of identical construction, standing side by side, and each worth $10,000. *A*, the owner of one, has his store insured for only $2000, while *B*, the owner of the other, has his store insured for $8000. A car catches fire on the driveway between the stores, and, before the blaze is estinguished, each store has been damaged to the extent of $1000. The insurance companies will indemnify each store owner to the same extent, even though *B* pays four times as much for his protection as *A*.

A survey conducted some years ago revealed that, of a thousand fires investigated, over 80% resulted in a loss of less than 20% of the value of the property. Storeowner *A* therefore feels that $2000 insurance will give him sufficient protection, and he is willing to carry the risk of a severe loss himself. If such a practice were generally followed, however, almost every loss would mean that the insurance company would pay the face of the policy, or at least a large percentage of the value insured, and the companies would be forced to increase the rates. This situation would place a terrific burden on the man who was willing to insure his property fully in order to guard against a total loss.

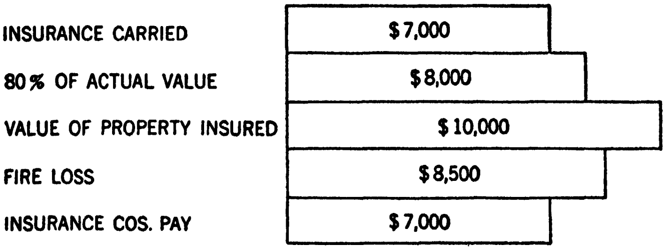
In order to meet this situation, the insurance companies devised the coinsurance (contribution or average) clause and allow large credits for its use. The lower rate induces property owners to increase the amount of insurance on their buildings.

80% Coinsurance Clause

To find the amount that insurance companies will pay under the coinsurance clause, divide the insurance carried by 80% of the value of the property insured and multiply the result by the amount of the loss. If the insurance is inadequate to cover the full loss, subtract the companies' share of the loss from the total loss to get the amount that the owner loses.

When insurance on property is divided between two or more companies, to find each company's share of the loss, divide the amount of insurance carried in each company by the total insurance and multiply the result by the loss to be paid by the companies.

Example 1. If the insured property is valued at $10,000 and the insurance carried is $7000, how much will the insurance companies pay on a loss of $8500?



Solution.

$$\frac{\$7000}{\$8000} = \frac{7}{8}$$

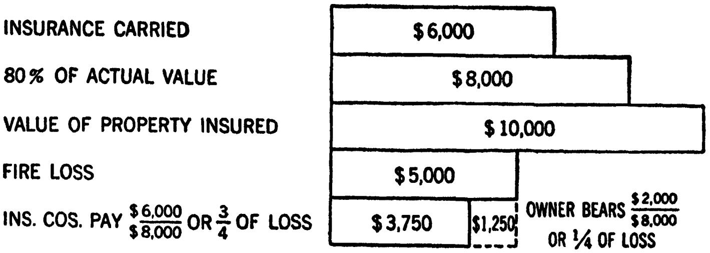
$$\frac{7}{8} \times \$8500 = \$7437.50$$

$7437.50 is more than face of policy.
Therefore, insurance companies will pay only the face of policy, or $7000.

Under the foregoing conditions, losses can be collected exactly the same as if the clause were *not* in the policy.

Under other conditions—that is, if the loss and the insurance are each less than 80% of the value—each insurance company pays the same part of the loss that it would have to pay if the insurance were 80%, but the owner bears the remainder of the loss.

Example 2. A building valued at $10,000 and insured for $6000 suffers a loss of $5000. (*a*) How much will the insurance companies pay? (*b*) What part of the loss will the owner bear?


INSURANCE CARRIED
$6,000
80% OF ACTUAL VALUE
$8,000
VALUE OF PROPERTY INSURED
$10,000
FIRE LOSS
$5,000
INS. COS. PAY $\frac{\$6,000}{\$8,000}$ OR $\frac{3}{4}$ OF LOSS
$3,750
$1,250
OWNER BEARS $\frac{\$2,000}{\$8,000}$ OR ¼ OF LOSS

Solution.

Insurance companies pay $\frac{\$6000}{\$8000}$, or $\frac{3}{4}$, of the loss of $5000, or $3750.

Owner bears $\frac{\$2000}{\$8000}$, or $\frac{1}{4}$, of the loss of $5000, or $1250.

Note that the insurance carried is $2000 less than 80% of the value, and that the amount of loss which the companies *do not* pay is that part which would be borne by $2000 more insurance.

Problems

Prove the accuracy of the apportionments in the following:

	Value	*Insurance*	*Insurance Required Under 80% Clause*	*Loss*	*Apportionment*	
					Company	*Policy-holder*
1.	$10,000	$6000	$8000	$1000	$750	$250
2.	$10,000	$6000	$8000	$8000	$6000	$2000
3.	$10,000	$8000	$8000	$2000	$2000	0

Divide the losses among the companies in proportion to the amounts of insurance carried:

	Fire Loss	*Insurance Carried by*		
		Company A	*Company* B	*Company* C
4.	$12,000	$15,000	$10,000	$5000
5.	$9000	$6000	$2000	$4000
6.	$8000	$3000	$2000	$5000

7. A merchant whose stock of merchandise is worth $15,000 carries the following fire insurance policies containing the 80% coinsurance clause: *A* Insurance Company, $4000; *B* Insurance Company, $6000. How much will each company pay on a loss of $9000?

8. Complete the following table (each policy contains an 80% coinsurance clause):

	Value of Property	*80% of Property Value*	*Amount of Insurance*	*Fire Loss*	*Amount Paid by Company*	*Amount Paid by Insured*
a.	$12,000	$	$ 8000	$1800	$	$
b.	6000		4000	2400		
c.	8000		4200	1600		
d.	14,000		10,000	6000		
e.	9000		6000	4200		
f.	10,000		7500	5000		

Chapter Test—Review

1. James Clark values his store building at $12,000 and his stock of goods at $8500. (*a*) What amount of insurance must be carried on each if they are insured for 80% of their value? (*b*) If the rate on the building is 65¢ per $100 for 3 yr., and the rate on the merchandise is 42¢ per $100 for 1 yr., what is Clark's average yearly cost for insurance?

2. W. L. Ames conducts a retail dry-goods business in a building which he owns. The building is valued at $45,000, and the stock of goods is inventoried at $13,200. He insures the building for 80% of its value at $16.50 per $1000 for 3 yr. and the stock at inventory value at $15.07 per $1000 for 1 yr. (*a*) Find the premium on the building. (*b*) Find the premium on the stock. (*c*) Find the average yearly cost of insurance on the building.

3. A. B. Henry, a druggist, owns a stock of goods inventoried at $4525 and a building valued at $15,000. He insures the stock for the inventoried value at $12.50 per $1000 for 1 yr. and the building for 80% of its value at $17.10 per $1000 for 3 yr. (*a*) Find the premium on the stock. (*b*) Find the premium on the building. (*c*) Find the total yearly cost of insurance.

4. A merchant insured a stock of merchandise for $5000 for 9 mo. What premium will he pay if the yearly rate is $2.80 per $100 and the premium for 9 mo. is 85% of the annual premium?

5. Suppose the $5000 policy in Problem 4 is written for 11 mo. Find the returned premium if 95% of the yearly premium is retained by the company.

6. A policy for $6000 is canceled by the insurance company 80 da. after it is issued. The premium was $33. What amount of the premium will be returned to the insured if the insurance company retains 38%?

7. A 3-yr. policy on which a premium of $90 is paid is canceled by the insured 19 mo. after it is issued. What will the return premium amount to if the insurance company retains 58%?

8. A building worth $50,000 and insured for $30,000 is damaged by fire to the extent of $12,000. If the policy contains the 80% coinsurance clause, how much will the insurance company have to pay?

9. A stock of merchandise is insured in three companies as follows: $20,000 in the Mutual; $25,000 in the Hartford; $35,000 in the National. The merchandise is valued at $100,000, and each policy contains the 80% coinsurance clause. If the merchandise is damaged to the extent of $40,000, how much will each company have to pay?

10. On a building worth $30,000, the following insurance policies were carried: Traders Insurance Co., $10,000; Mutual Underwriters, $6000; Security National Insurance Co., $14,000. How much should each company pay on a fire loss of $9650?

11. A firm had the machinery in one of its factories insured for three-fifths of its value. The policy was for $45,000 and contained the 80% coinsurance clause. A fire damaged the machinery to the extent of $24,000. How much did the insurance company have to pay?

12. A mill valued at $30,000 and its contents valued at $15,000 were insured for two-thirds of their value. The policies contained the 80% coinsurance clause. The mill was totally destroyed, and the contents were damaged to the extent of $10,000. Find how much the insurance company had to pay.

Speed Drills in Fundamentals

Test 7

Add:

1. $18.20
9.10
17.55
4.55
3.25
1.95
3.90
6.50

2. 35 %
7.5%
22 %
10 %
5 %
5 %
14.5%
14.5%

3. 421
264
743
431
732
835
896
784
399
945

4. $ 642.75
755.89
2436.64
1833.72
345.53
761.44
1875.73
2364.38

5. $18\frac{1}{3}$ yd.
$14\frac{1}{4}$ yd.
$13\frac{1}{12}$ yd.
$26\frac{1}{2}$ yd.

6. $17\frac{2}{3}$ yd.
$25\frac{1}{3}$ yd.
$36\frac{1}{2}$ yd.
$48\frac{3}{4}$ yd.

Subtract:

7. \$45 − \$.45
8. \$82.50 − \$1.24
9. \$34.25 − \$.69
10. \$438.86 − \$2.19
11. \$256.75 − \$3.85
12. \$375.21 − \$7.50

Multiply:

13. 784 × 3800
14. 59.75 × 48.5
15. $575\frac{3}{4} \times 3\frac{1}{2}$
16. \$390.75 × 15%
17. .70 × .90
18. \$6424 × $\frac{1}{8}$%
19. \$3550 × 125%
20. \$2486.40 × $2\frac{1}{2}$%
21. \$840.75 × $\frac{7}{8}$
22. $356\frac{3}{4} \times 28\frac{1}{2}$
(Use 4-step method.)

Divide:

23. \$165 ÷ .3
24. \$40.70 ÷ \$55
25. \$29.50 ÷ \$45
26. \$157,385,650 ÷ \$3,750,740
27. 595.25 ÷ $24\frac{3}{4}$
28. $283\frac{1}{2} \div 14\frac{1}{2}$

Find:

29. 35.5% of 360
30. 27.4% of 360
31. 37.1% of 360
32. $\frac{1}{4}$% of \$112.80
33. 110% of \$88.75
34. $1\frac{1}{8}$% of \$47.50

Complete:

35. 960 increased by 5% is ____.
36. 36 decreased by 25% is ____.
37. 600 increased by 12% is ____.
38. 24 decreased by $8\frac{1}{3}$% is ____.

Find the price of each of the following lots:

39. 40′ × 120′ @ \$2.00 per square foot.
40. 50′ × 125′ @ \$2.50 per square foot.
41. 60′ × 250′ @ \$1.75 per square foot.
42. 50′ × 150′ @ \$1.00 per square foot.
43. 75′ × 300′ @ \$2.25 per square foot.

Find the commissions:

44. \$1200 @ 8%
45. \$1500 @ 6%
46. \$8000 @ $3\frac{1}{2}$%

Find the amount of taxes:

47. \$5000 − 28 mills
48. \$8000 − 2.85 per \$100
49. \$1200 − 31%
50. \$7000 − 32 mills

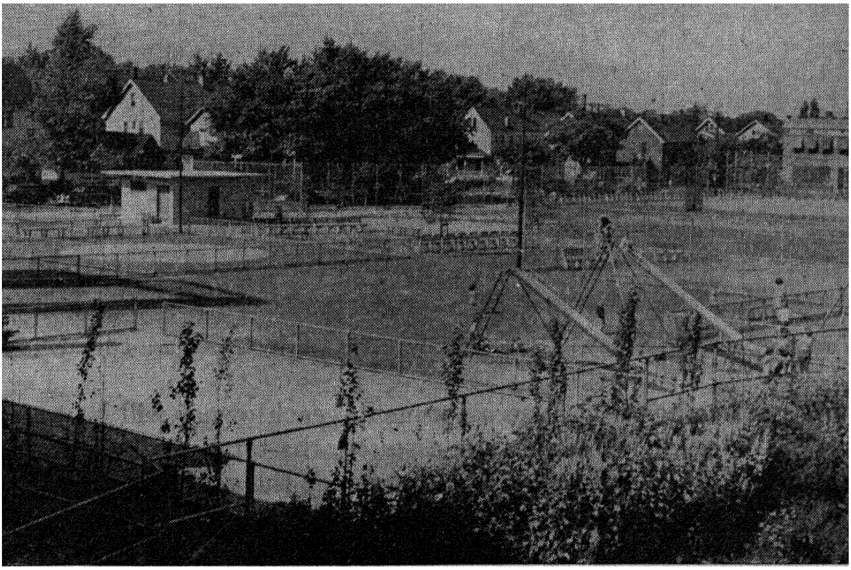
Chapter 12

Taxation

UNIT 1

Real Estate Taxes

WHETHER a person owns his home or rents it, he is part of a community that supplies him with many different types of service. The city, town, or village maintains a police department and a fire department for the protection of his home, cleans the streets, provides schools, parks, and hospitals, and performs many other functions that are necessary in present-day life. Naturally, all this costs money, and a great part of this cost is obtained by taxing the owners of homes. The man who is a tenant does not escape



A City Playground. Playgrounds are supported by property taxes. Children in crowded districts benefit as well as the whole community.

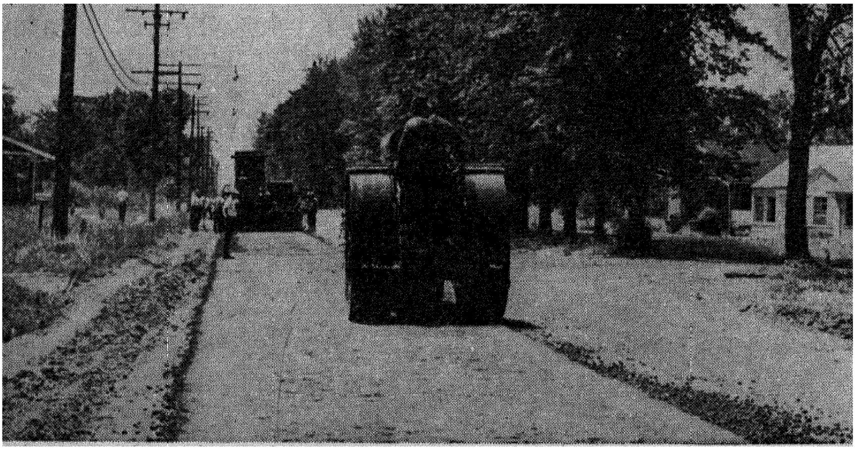
this tax, since it is included in his rent. Just how is each homeowner taxed when each piece of property has a different value? Let us see.

Tax Budgets

It is the common practice for the city, town, or village to prepare annually a list of estimated expenses by departments for the coming year. Such an itemized list is called a *tax-budget* and is similar to the budget of a family.

How Taxes Are Apportioned

After the budget has been approved by the proper authorities, the need then arises for taxing each homeowner his proportionate share of the total. To determine this amount, all the property in the city is *assessed* a definite value by a corps of assessors. These men inspect every piece of property and assign a definite value to it, basing their estimates on real estate costs in each neighborhood, and, on the basis of these assessments, each owner will be taxed. After each piece of property is assessed, the total of all the assessments is found, and this total is known as the *assessed valuation* of all the property of the city, town, or village.



Paving a Street. Paved streets are a necessity. This activity is maintained by city taxes.

With this sum determined, each homeowner then pays the proportion of the total taxes needed by the city that his property bears to the total assessed valuation of all the property.

Finding the Tax Rate

Example 1. If the total assessed valuation of a city with a budget of \$4,221,890.49 is \$150,781,803.21, what will be the tax rate?

Solution. \$4,221,890.49 ÷ \$150,781,803.21 = .028, tax rate.

Proof. \$150,781,803.21 × .028 = \$4,221,890.49, amount needed.

The tax rate may be expressed in the following three ways:

1. For each dollar of assessed valuation of each person's property, the tax is \$.028, or $2\frac{8}{10}$¢, or 28 mills. (1 mill = $\frac{1}{10}$¢)
2. For each hundred dollars of assessed valuation of each person's property, the tax is \$2.80. (\$.028 × 100 = \$2.80)
3. For each thousand dollars of assessed valuation of each person's property, the tax is \$28. (\$.028 × 1000 = \$28)

Fill in the correct forms for each rate:

No.	*Rate in %*	*Rate in Mills*	*Dollar Rate per Hundred*	*Dollar Rate per Thousand*
1.	2.8%			
2.		33.9		
3.			\$3.45	
4.				\$31.50
5.		29		
6.	2.76%			
7.			\$3.13	
8.				\$23.20
9.		32.6		
10.	3.1%			

Finding the Amount of Tax

Example 2. William Frank owns real property assessed at \$7800 in the city for which the tax rate was computed in Example 1. If the tax rate in this city is expressed as \$2.80 per \$100, how much will his taxes be?

Solution. \$7800 ÷ \$100 = 78

78 × \$2.80 = \$218.40, amount of tax.

Proof. 78 × \$2 = \$156

78 × \$.80 = \$62.40

\$156 + \$62.40 = \$218.40, amount of tax.

Finding the Total Assessment

If the amount of taxes to be raised and the estimated tax rate are known, the assessed valuation of all the real property in the city can be found.

EXAMPLE 3. A tax roll shows a total of $18,837,091.28, and the estimated tax rate is $2.13 per $100. What is the total of the assessment roll?

SOLUTION.

$2.13 per $100 = $.0213 per $1

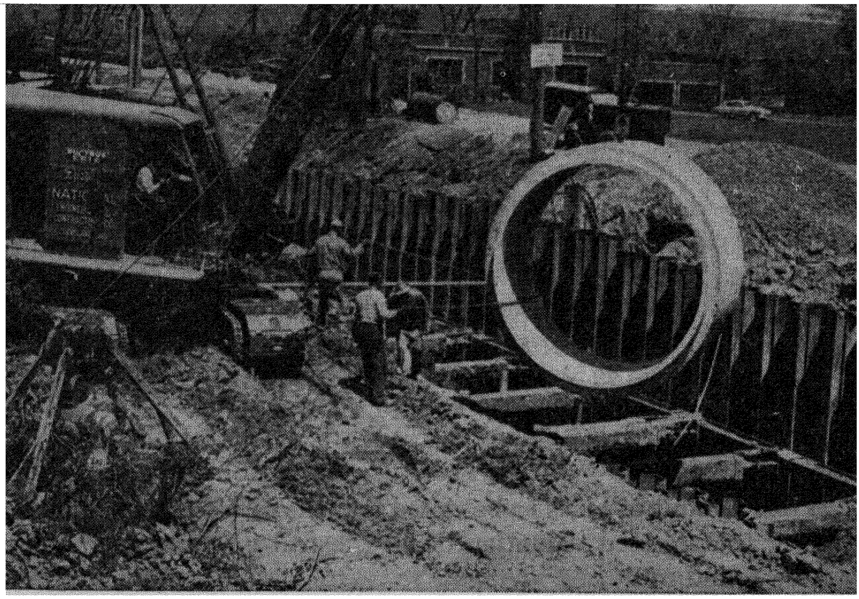
$18,837,091.28 ÷ $.0213 = $884,370,482.63, total assessment.

Problems

GROUP 1

Find the assessed valuation and amount of tax on each of the following:

No.	*Actual Value*	*Per cent of Valuation*	*Assessed Valuation*	*Tax Rate*	*Amount of Tax*
1.	$ 8500	55%	$	35 mills	$
2.	10,500	60%		$ 2.69 per hundred	
3.	12,500	62½%		$24.90 per thousand	
4.	6750	75%		1.54 per cent	
5.	18,000	100%		23.8 mills	
6.	24,000	87½%		2.09 per cent	
7.	65,500	50%		$ 3.18 per hundred	
8.	125,000	65%		37 mills	
9.	175,000	40%		$23.80 per thousand	
10.	225,000	45%		$ 1.93 per hundred	



Building a City Sewerage System. An important city service financed by property taxes.

Group 2

1. The assessment roll shows the valuation of taxable property in a certain city to be $41,483,370, and the tax roll shows taxes to be collected amounting to $1,041,232.59. Find the tax rate per $100 of assessed valuation.

2. A city assessment roll totals $586,710,312, and the tax roll totals $12,526,265.16. (*a*) Find the tax rate per $100 of assessed valuation. (*b*) How much tax would the owner of a property assessed at $11,500 have to pay?

3. What is the tax on property assessed for $3950 if the tax rate is $1\frac{7}{8}\%$?

4. What is the total tax on two pieces of property assessed for $2300 and $5100, respectively, if the tax rate is $1.93 per $100?

5. What is the total tax on a piece of property assessed for $21,500 if the city tax rate is $.0128, the county and state tax rate is $.0054, and the school tax rate is $.0063 per $1 of assessed valuation?

6. The taxable property in a village is assessed at $17,263,000. The total amount necessary to meet the expenses of the village government for the coming year is $524,600. It is estimated that $2500 will be received from special licenses and $75,300 will be received from other sources. (*a*) Find the tax rate. (Carry the decimal to five places.) (*b*) Express the rate in dollars per $1000. (*c*) What is the tax on a property valued at $7500 and assessed at 80% of its value?

7. The total tax budget of the village of Brenton is $162,652. If the tax rate is 23.6 mills per dollar, what is the total assessed valuation of the real estate of the village?

8. The tax rate for schools in a city district is $1.84 per hundred. If John Minor's property is assessed for $6540, what is the amount of his school tax?

9. Albert Williams owns one property worth $12,000 which is assessed at 60% of its value and another property worth $18,000 assessed at 65% of its value. What does he pay in taxes if the rate is 32 mills?

10. In a certain county, the county tax is 6 mills, the school tax is 18 mills, and the city tax is 24 mills. What will John Carlson pay in property taxes on his house assessed at $12,500?

UNIT 2

Income Taxes

A TAX on income is levied by the United States Government in order to obtain the necessary funds to pay the expenses of the Federal Government. Tax rates and income tax laws are modified from time to time, but the following discussion, examples, and problems will illustrate the basic ideas.

Courtesy Douglas Aircraft Co.

Employees of an Airplane Factory. Income taxes paid by individuals help finance our federal government.

One method of paying one's income tax is the use of Form 1040A. In order to qualify for this form, you must meet the following conditions:

1. Your total income must be less than $5000.
2. Your income must have consisted entirely of wages reported on withholding statements (Form W-2), or items listed in 3 below.
3. Your income may include not more than $100 in other wages (other than in 2), dividends, and interest.

If these conditions are met, you may use Form 1040A, and on the basis of your answers to questions on this form the Collector will compute your tax and send you a bill or a refund.

Another method of filing a return is on Form 1040. This may be used with either the Tax Table or the proper rate schedule, of which the Tax Table is the simpler. Form 1040 differs from Form 1040A in these respects:

1. You must find your own tax.
2. You include income from sources not eligible for Form 1040A.
3. You may deduct travel expenses and reimbursed expenses from your wages.

If your income was less than $5000 and you do not desire to itemize non-business deductions, find your tax from the Tax Table (reproduced on pages 188 and 189), and file Form 1040.

Example 1. Mr. Edwin Jackson's income consists of $4800 in wages and $40 in dividends. He is married and is the father of two children. He may use the Tax Table to find his tax.

Solution. His total income is $4840. The number of exemptions, counting himself, his wife, and two children, is 4. In the Tax Table, in the row $4800–$4850, in the column headed 4, we read *$389*. This is Mr. Jackson's tax.

Problems

Use the Tax Table to find the income tax:

	Total Income	*Status*
1.	$3640	Single person, no dependents
2.	$4210	Married couple, one child
3.	$4720	Married couple, filing jointly, no children
4.	$4140	Married person, filing separately
5.	$3870	Single person, dependent mother
6.	$3200	Single person, no dependents

TAX TABLE FOR CALENDAR YEAR 1956

FOR PERSONS WITH INCOMES UNDER $5,000 NOT COMPUTING TAX ON PAGE 2 OF FORM 1040

Read down the income columns below until you find the line covering the adjusted gross income you entered on line 11, page 1, Form 1040. Then read across to the appropriate column headed by the number corresponding to the number of exemptions claimed on line 4, page 1. Enter the tax you find there on line 12, page 1.

If total income on line 11, page 1, is—		And the number of exemptions claimed on line 4, page 1, is—				If total income on line 11, page 1, is—		And the number of exemptions claimed on line 4, page 1, is—												
At least	But less than	1	2	3	4 or more	At least	But less than	1 And you are—		2 And you are—			3 And you are—			4	5	6	7	8 or more
								Single or a married person filing separately	An unmarried head of a household	Single or a married person filing separately	An unmarried head of a household	★ A married couple filing jointly	Single or a married person filing separately	An unmarried head of a household	★ A married couple filing jointly					
		Your tax is—						Your tax is—												
$0	$675	$0	$0	$0	$0	$2, 325	$2, 350	$301	$301	$181	$181	$181	$61	$61	$61	$0	$0	$0	$0	$0
675	700	4	0	0	0	2, 350	2, 375	305	305	185	185	185	65	65	65	0	0	0	0	0
700	725	8	0	0	0	2, 375	2, 400	310	310	190	190	190	70	70	70	0	0	0	0	0
725	750	13	0	0	0	2, 400	2, 425	314	314	194	194	194	74	74	74	0	0	0	0	0
750	775	17	0	0	0	2, 425	2, 450	319	319	199	199	199	79	79	79	0	0	0	0	0
775	800	22	0	0	0	2, 450	2, 475	323	323	203	203	203	83	83	83	0	0	0	0	0
800	825	26	0	0	0	2, 475	2, 500	328	328	208	208	208	88	88	88	0	0	0	0	0
825	850	31	0	0	0	2, 500	2, 525	332	332	212	212	212	92	92	92	0	0	0	0	0
850	875	35	0	0	0	2, 525	2, 550	337	337	217	217	217	97	97	97	0	0	0	0	0
875	900	40	0	0	0	2, 550	2, 575	341	341	221	221	221	101	101	101	0	0	0	0	0
900	925	44	0	0	0	2, 575	2, 600	346	346	226	226	226	106	106	106	0	0	0	0	0
925	950	49	0	0	0	2, 600	2, 625	350	350	230	230	230	110	110	110	0	0	0	0	0
950	975	53	0	0	0	2, 625	2, 650	355	355	235	235	235	115	115	115	0	0	0	0	0
975	1, 000	58	0	0	0	2, 650	2, 675	359	359	239	239	239	119	119	119	0	0	0	0	0
1, 000	1, 025	62	0	0	0	2, 675	2, 700	364	364	244	244	244	124	124	124	4	0	0	0	0
1, 025	1, 050	67	0	0	0	2, 700	2, 725	368	368	248	248	248	128	128	128	8	0	0	0	0
1, 050	1, 075	71	0	0	0	2, 725	2, 750	373	373	253	253	253	133	133	133	13	0	0	0	0
1, 075	1, 100	76	0	0	0	2, 750	2, 775	377	377	257	257	257	137	137	137	17	0	0	0	0
1, 100	1, 125	80	0	0	0	2, 775	2, 800	382	382	262	262	262	142	142	142	22	0	0	0	0
1, 125	1, 150	85	0	0	0	2, 800	2, 825	386	386	266	266	266	146	146	146	26	0	0	0	0
1, 150	1, 175	89	0	0	0	2, 825	2, 850	391	391	271	271	271	151	151	151	31	0	0	0	0
1, 175	1, 200	94	0	0	0	2, 850	2, 875	395	395	275	275	275	155	155	155	35	0	0	0	0
1, 200	1, 225	98	0	0	0	2, 875	2, 900	400	400	280	280	280	160	160	160	40	0	0	0	0
1, 225	1, 250	103	0	0	0	2, 900	2, 925	405	404	284	284	284	164	164	164	44	0	0	0	0
1, 250	1, 275	107	0	0	0	2, 925	2, 950	410	409	289	289	289	169	169	169	49	0	0	0	0
1, 275	1, 300	112	0	0	0	2, 950	2, 975	415	414	293	293	293	173	173	173	53	0	0	0	0
1, 300	1, 325	116	0	0	0	2, 975	3, 000	420	419	298	298	298	178	178	178	58	0	0	0	0
1, 325	1, 350	121	1	0	0	3, 000	3, 050	427	426	305	305	305	185	185	185	65	0	0	0	0
1, 350	1, 375	125	5	0	0	3, 050	3, 100	437	435	314	314	314	194	194	194	74	0	0	0	0
1, 375	1, 400	130	10	0	0	3, 100	3, 150	447	445	323	323	323	203	203	203	83	0	0	0	0
1, 400	1, 425	134	14	0	0	3, 150	3, 200	457	454	332	332	332	212	212	212	92	0	0	0	0
1, 425	1, 450	139	19	0	0	3, 200	3, 250	467	464	341	341	341	221	221	221	101	0	0	0	0
1, 450	1, 475	143	23	0	0	3, 250	3, 300	476	473	350	350	350	230	230	230	110	0	0	0	0
1, 475	1, 500	148	28	0	0	3, 300	3, 350	486	482	359	359	359	239	239	239	119	0	0	0	0
1, 500	1, 525	152	32	0	0	3, 350	3, 400	496	492	368	368	368	248	248	248	128	8	0	0	0
1, 525	1, 550	157	37	0	0	3, 400	3, 450	506	501	377	377	377	257	257	257	137	17	0	0	0
1, 550	1, 575	161	41	0	0	3, 450	3, 500	516	511	386	386	386	266	266	266	146	26	0	0	0
1, 575	1, 600	166	46	0	0	3, 500	3, 550	526	520	395	395	395	275	275	275	155	35	0	0	0
1, 600	1, 625	170	50	0	0	3, 550	3, 600	536	530	404	404	404	284	284	284	164	44	0	0	0
1, 625	1, 650	175	55	0	0	3, 600	3, 650	546	539	414	413	413	293	293	293	173	53	0	0	0
1, 650	1, 675	179	59	0	0	3, 650	3, 700	556	549	424	423	422	302	302	302	182	62	0	0	0
1, 675	1, 700	184	64	0	0	3, 700	3, 750	566	558	434	432	431	311	311	311	191	71	0	0	0
1, 700	1, 725	188	68	0	0	3, 750	3, 800	575	567	443	441	440	320	320	320	200	80	0	0	0
1, 725	1, 750	193	73	0	0	3, 800	3, 850	585	577	453	451	449	329	329	329	209	89	0	0	0
1, 750	1, 775	197	77	0	0	3, 850	3, 900	595	586	463	460	458	338	338	338	218	98	0	0	0
1, 775	1, 800	202	82	0	0	3, 900	3, 950	605	596	473	470	467	347	347	347	227	107	0	0	0
1, 800	1, 825	206	86	0	0	3, 950	4, 000	615	605	483	479	476	356	356	356	236	116	0	0	0
1, 825	1, 850	211	91	0	0	4, 000	4, 050	625	615	493	489	485	365	365	365	245	125	5	0	0
1, 850	1, 875	215	95	0	0	4, 050	4, 100	635	624	503	498	494	374	374	374	254	134	14	0	0
1, 875	1, 900	220	100	0	0	4, 100	4, 150	645	634	513	508	503	383	383	383	263	143	23	0	0
1, 900	1, 925	224	104	0	0	4, 150	4, 200	655	643	523	517	512	392	392	392	272	152	32	0	0
1, 925	1, 950	229	109	0	0	4, 200	4, 250	665	653	533	527	521	401	401	401	281	161	41	0	0
1, 950	1, 975	233	113	0	0	4, 250	4, 300	674	662	542	536	530	410	410	410	290	170	50	0	0
1, 975	2, 000	238	118	0	0	4, 300	4, 350	684	671	552	545	539	420	419	419	299	179	59	0	0
2, 000	2, 025	242	122	2	0	4, 350	4, 400	694	681	562	555	548	430	429	428	308	188	68	0	0
2, 025	2, 050	247	127	7	0	4, 400	4, 450	704	690	572	564	557	440	438	437	317	197	77	0	0
2, 050	2, 075	251	131	11	0	4, 450	4, 500	714	700	582	574	566	450	448	446	326	206	86	0	0
2, 075	2, 100	256	136	16	0	4, 500	4, 550	724	709	592	583	575	460	457	455	335	215	95	0	0
2, 100	2, 125	260	140	20	0	4, 550	4, 600	734	719	602	593	584	470	467	464	344	224	104	0	0
2, 125	2, 150	265	145	25	0	4, 600	4, 650	744	728	612	602	593	480	476	473	353	233	113	0	0
2, 150	2, 175	269	149	29	0	4, 650	4, 700	754	738	622	612	602	490	486	482	362	242	122	2	0
2, 175	2, 200	274	154	34	0	4, 700	4, 750	764	747	632	621	611	500	495	491	371	251	131	11	0
2, 200	2, 225	278	158	38	0	4, 750	4, 800	773	756	641	630	620	509	504	500	380	260	140	20	0
2, 225	2, 250	283	163	43	0	4, 800	4, 850	783	766	651	640	629	519	514	509	389	269	149	29	0
2, 250	2, 275	287	167	47	0	4, 850	4, 900	793	775	661	649	638	529	523	518	398	278	158	38	0
2, 275	2, 300	292	172	52	0	4, 900	4, 950	803	785	671	659	647	539	533	527	407	287	167	47	0
2, 300	2, 325	296	176	56	0	4, 950	5, 000	813	794	681	668	656	549	542	536	416	296	176	56	0

★ This column may also be used by a widow or widower who meets certain qualifications which are explained on page 7 of these instructions.

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7.	$1200	Single person, no dependents
8.	$2975	Single person, no dependents
9.	$3245	Married couple, three children
10.	$3975	Married couple, four children

If your income was $5,000 or more, you *must* use Form 1040 and the proper rate schedule. In this case you can either take a standard deduction or itemize and claim your actual deductions. If you are single, or if you are married and file a joint return, you can deduct 10% of your income but not more than $1000.

It is not our purpose to discuss the rate schedule method, but two examples will illustrate the general idea.

1956 TAX RATE SCHEDULE*

$ 0 to $ 2,000		20%		
2,000 to 4,000	$ 400	plus 22%	of amount over	$ 2,000
4,000 to 6,000	840	plus 26%	of amount over	4,000
6,000 to 8,000	1,360	plus 30%	of amount over	6,000
8,000 to 10,000	1,960	plus 34%	of amount over	8,000
10,000 to 12,000	2,640	plus 38%	of amount over	10,000
12,000 to 14,000	3,400	plus 43%	of amount over	12,000
14,000 to 16,000	4,260	plus 47%	of amount over	14,000
16,000 to 18,000	5,200	plus 50%	of amount over	16,000
18,000 to 20,000	6,200	plus 53%	of amount over	18,000
20,000 to 22,000	7,260	plus 56%	of amount over	20,000
22,000 to 26,000	8,380	plus 59%	of amount over	22,000
26,000 to 32,000	10,740	plus 62%	of amount over	26,000
32,000 to 38,000	14,460	plus 65%	of amount over	32,000
38,000 to 44,000	18,360	plus 69%	of amount over	38,000
44,000 to 50,000	22,500	plus 72%	of amount over	44,000
50,000 to 60,000	26,820	plus 75%	of amount over	50,000
60,000 to 70,000	34,320	plus 78%	of amount over	60,000
70,000 to 80,000	42,120	plus 81%	of amount over	70,000
80,000 to 90,000	50,220	plus 84%	of amount over	80,000
90,000 to 100,000	58,620	plus 87%	of amount over	90,000
100,000 to 150,000	67,320	plus 89%	of amount over	100,000
150,000 to 200,000	111,820	plus 90%	of amount over	150,000
200,000 and over	156,820	plus 91%	of amount over	200,000

* For all taxpayers except head of household.

Rate Schedule Method

EXAMPLE 1. Mr. Patrick Smiley is single and has a dependent mother living in a nursing home. His income is $8000. Business expenses amount to $500. Compute his income tax.

SOLUTION.

Gross income	$8000
Business expenses	500
Adjusted gross income	$7500
Standard Deduction (10%)	750
Net income	$6750
$600 × 2 (no. of exemptions)	1200
Taxable net income	$5550

Tax computation from rate schedule on page 190 is \$840, plus 26% of excess over \$4000.

$$\begin{aligned} \$5550 - \$4000 &= \$1550 \\ 26\% \times \$1550 &= \$403 \\ \$840 + \$403 &= \$1243 \end{aligned}$$

Example 2. Mr. L. B. Atkins is married and has two children. His total income is \$10,000. Business expenses amount to \$900. Compute his income tax.

Solution.

Gross income	\$10,000	
Business expenses	900	
Adjusted gross income	\$9,100	
Deduct 10%	910	
Net income	\$8,190	
\$600 × 4 (no. of exemptions)	2,400	
Taxable income	\$5,790	
One-half (joint return)	2,895	
Tax on first \$2,000 at 20%		\$400.00
Tax on \$895 at 22%		196.90
Tax on \$2,895		\$596.90

2 × \$596.90 = \$1193.80 tax.

Problems

Find the income tax for each of the following:

1. Gross income, \$6000; single, living apart from his dependent father and mother; \$400 deductible business expenses.

2. Gross income, \$7000; single, no dependents; \$1000 deductible business expense.

3. Gross income, \$8000; married, joint return, 3 dependent children.

4. Gross income, \$10,000; married, joint return, 4 dependent children; \$1500 deductible business expenses.

5. Gross income, \$15,000; married, joint return, 1 dependent child; \$2000 deductible business expenses.

Chapter Test—Review

1. If the total assessed valuation of the city whose budget is given in Example 1 of Unit 1 is \$160,243,175.28, what will be the tax rate?

2. Using the tax rate obtained in Problem 1, what will be the tax on real property assessed at \$18,600?

3. A tax roll shows a total of \$68,432,273.89, and the estimated tax rate is \$3.84 per \$100. What is the total of the assessment roll?

4. A city's assessment roll shows the valuation of taxable property to be $98,146,480, and the tax roll shows taxes to be collected amounting to $4,162,893.92. Find the tax rate per $100 of assessed valuation.

5. Mr. Earl Miller is married and is the father of two children. His income consists of $4700 in wages and $80 in dividends. Use the Tax Table to find his tax.

6. Mr. Charles Herrera is single and lives apart from his dependent mother and father. His income is $6500. Business expenses amount to $600. Compute his income tax.

7. Mr. A. C. Seeley is married and has three children. His income is $8000. Business expenses amount to $500. Compute his income tax.

Speed Drills in Fundamentals

Test 8

Add horizontally:

1. 667; 548; 478; 421; 297; 691.
2. 35; 511; 528; 373; 165; 4272.
3. 5.89; 17.654; 2.0473; 0.0075; 5.3.
4. 354.21; 5.53; 9.007; 0.145; 0.0805; 3.5.
5. 34.31; 5.54; 17.0903; 13.0045; 6.107; 25.2.

Subtract:

6. 59,678.05 39,987.3	**7.** $21\frac{3}{8}$ $9\frac{3}{4}$	**8.** $58{,}741\frac{2}{3}$ 39,867
9. 14 $8\frac{4}{5}$	**10.** 83,242 $57{,}979\frac{3}{8}$	**11.** 25.5 $17\frac{1}{8}$

Multiply:

12. 785 357	**13.** 51.82 4.73	**14.** $25\frac{2}{5}$ $15\frac{2}{3}$
15. 8408 .00125	**16.** $4575 $137\frac{1}{2}\%$	**17.** 2680 lbs. $8 per ton

Find the cost:

18. 78 lbs. @ $33\frac{1}{2}$¢
19. 240 lbs. @ $67\frac{1}{2}$¢
20. 180 lbs. @ 75¢
21. 480 lbs. @ $8\frac{1}{3}$¢

Divide:

22. $.80\overline{)7597.32}$

23. $.005\overline{)8792.50}$

24. $12.5\overline{)16585}$

25. $.75\overline{)\$25}$

26. $.60\overline{)33}$

27. $32\frac{1}{3}\overline{)\$62}$

28. $.25\frac{1}{2}\overline{)\$127.50}$

29. $\$132 \div 6\frac{2}{3}\%$.

30. $\$180 \div 37\frac{1}{2}\%$.

Find:

31. 1% of $147.50

32. $8\frac{1}{3}\%$ of $732

33. $2\frac{1}{4}\%$ of $160

34. $37\frac{1}{2}\%$ of $240

35. $83\frac{1}{3}\%$ of $330

36. $\frac{1}{8}\%$ of $240.88

Find the annual insurance cost of the following policies:

37. $6000 – .15

38. $10,000 – .20

39. $12,000 – .32

40. $7000 – .24

Change to common fractions and reduce to lowest terms:

41. 5%

42. $4\frac{1}{4}\%$

43. 2.9%

44. $\frac{3}{8}\%$

45. $\frac{4}{5}\%$

46. 125%

47. $2\frac{3}{4}\%$

48. 250%

49. $\frac{1}{2}\%$

50. 55%

Chapter 13

Consumer Credit

The Extent and Value of Credit

CONSUMER CREDIT plays a very important part in the economy of the United States. Almost everyone uses credit in his contact with the family physician and dentist and in his purchases of electricity, gas, telephone service, milk, and newspaper. The yearly installment and non-installment credit of this country runs into the billions of dollars.

With credit, Mr. Average Citizen buys his home, keeps it in repair, furnishes it with carpets, furniture, and appliances, and buys his clothes and supplies at the retail stores. The businessman expands his business and develops new products with credit. The farmer buys seed, fertilizer, and equipment with credit to increase his production. In fact, the nation could not exist without consumer credit.

UNIT 1

Installment Buying

MANY BUYERS do not pay cash for such articles as refrigerators, furniture, television sets, stoves, and washing machines. Most of these articles are bought on the installment plan, which provides for a certain per cent of the purchase price to be paid as a down payment and the balance to be paid in monthly installments. These payments usually run for 12 or 18 months.

As far as volume of dollars is concerned, the purchase of automobiles by installments is first in the country.

Installment buying has some advantages to the purchaser. It enables him to make a purchase with a comparatively small amount of money. He has the use of the article while he is paying for it. The principal disadvantage is the interest and the service charge

Courtesy General Electric Company

A Television Console. Installment purchases of television sets rank among the highest of all household goods.

which he must pay for the privilege of paying the balance by the month. Also, by the time the article is paid for, depreciation and use may have lessened the value of the article considerably.

Example. A used car with a price tag of $1010 was advertised for sale at a reduction in price of $35. The down payment was $337.60 and the monthly payment $43.61 for 18 months. Find the sale price, the balance due, the total amount paid for the car, and the total of taxes, fees, and interest.

SOLUTION.

$1010.00, original price.
35.00, amount of reduction.
$ 975.00, *sale price.*
337.60, down payment.
$ 637.40, *balance due.*
18 × $43.61 = $ 784.98, total monthly payments.
337.60, down payment.
$1122.58, *total paid for car.*
$ 784.98, total monthly payments.
637.40, balance due.
$ 147.58, *amount of taxes, fees, interest.*

Problems

The prices in the following table were advertised in a sale of used automobiles. All taxes, title fees, and interest were included in the sale price.

Complete the following table. All monthly payments are to run 18 months:

USED-CAR PURCHASES

Car	*Original Price*	*Reduction*	*Sale Price*	*Down Payment*	*Balance Due*	*Monthly Payment*	*Total Paid for Car*	*Total for Taxes, etc.*
1.	$1298	$ 23		$440.00		$ 56.44		
2.	2862	167		928.20		116.22		
3.	1372	97		440.60		56.44		
4.	2474	179		790.20		99.16		
5.	960	65		310.20		40.20		
6.	1960	165		619.20		77.76		
7.	1112	117		344.20		44.49		
8.	1338	243		384.20		48.41		
9.	1078	83		344.20		44.49		
10.	1303	208		384.20		48.41		

UNIT 2

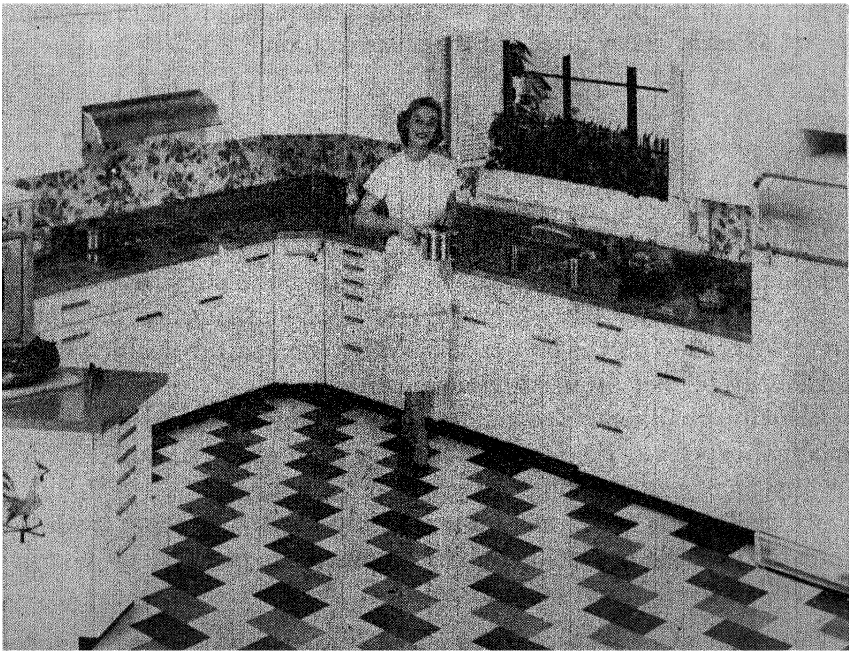
Purchasing Household Equipment and Appliances

IN ADDITION to the financing of the purchase of automobiles, credit is widely used in the purchase of stoves, dishwashers, ironers, refrigerators and food freezers, washing machines and clothes dryers, sewing machines, suction cleaners, furniture, floor coverings, and radio and television sets. The usual down payment required is 15% or more, and the balance is required to be paid in 18 months or less.

Example. A man purchases an electric refrigerator for \$225.00 including taxes. He pays 15% down, 7% a year for service charges, and the balance in 18 equal monthly payments. (*a*) What is the amount of his down payment? (*b*) What is the balance owed? (*c*) What is the amount of each monthly payment?

Solution.

15% of \$225 = \$ 33.75, down payment.
\$225 − \$33.75 = \$191.25, balance owed.
10½% of \$191.25 = 20.08, service charge for 18 months.
\$211.33, total amount owed.
\$211.33 ÷ 18 = \$ 11.74, amount of monthly payment.



A Modern Kitchen. Equipment such as refrigerators, stoves, dish-washers, and small electrical appliances found in a modern kitchen are purchased on the installment plan.

Problems

1. Frank Church purchased a television set for $256. He paid 15% down, 8% finance charges, and the balance in 12 equal payments. (*a*) What was the amount of the down payment? (*b*) What was the amount owed? (*c*) What was the amount of each monthly payment?

2. John Gideon bought a vacuum sweeper for $75. He paid 15% down, 6% service charges, and the balance in 12 monthly payments. How much would he have saved by paying cash?

3. Mrs. Charles Hall purchased a washing machine for $125 and an ironer for $150. She financed both of them on the same account. She paid 20% down, 7% interest and service charges, and the balance in 12 equal monthly payments. (*a*) What was the amount of the down payment? (*b*) What was the total amount owed? (*c*) What was the amount of each monthly payment?

4. Mrs. Joseph Lynn purchased carpet for her living room at a cost of $320. She paid 15% in cash and financed the balance through the special purchase plan of $16.20 for 18 months. How much more did it cost Mrs. Lynn for the time payments?

5. Thomas McAlpin purchased an electric range for $280. He paid one-fourth of the purchase price in cash and the remainder in 12 payments of $18.42 each. How much did the range cost him?

UNIT 3

Small-Loan Companies

Many loan companies exist for the sole purpose of loaning small amounts of money for personal use. Many of our banks now have personal loan departments which serve the same purpose.

Individuals may borrow money to buy something for the home, to make repairs on the house, or for other expenditures which might ordinarily be met by installment purchases.

Usually small loans are made to pay off a number of small debts, medical expenses, taxes, insurance, vacation expense, auto repairs, or any unexpected or unusual expense.

All such loans are repaid on a monthly basis. In some cases the interest charges are deducted in advance; in others, the charges are added to the total amount owed.

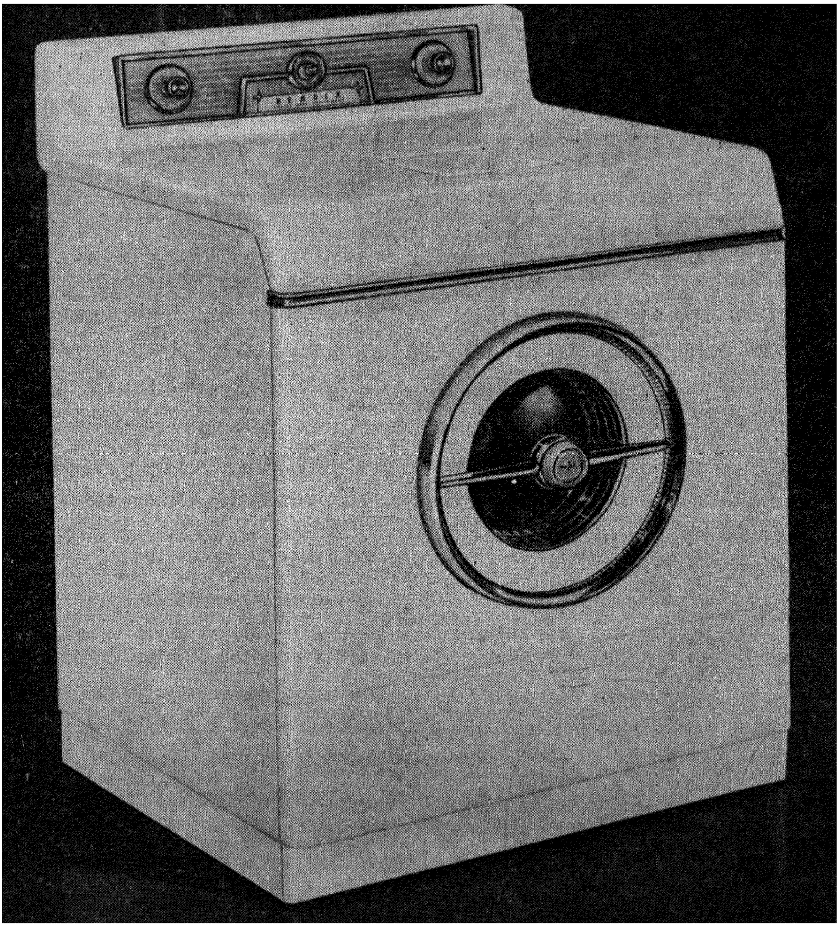
Example. An $80 loan is to be repaid at the rate of $8.06 a month for 12 months, $6.72 for 15 months, or $5.40 for 20 months. What is the cost of the loan in each case?

Solution.

12 × $8.06 = $96.72
Amount of loan = 80.00
Cost of loan for
12 months = $16.72

15 × $6.72 = $100.80
Amount of loan = 80.00
Cost of loan for
15 months = $ 20.80

20 × $5.40 = $108.00
Amount of loan = 80.00
Cost of loan for
20 months = $ 28.00



Courtesy Bruno, New York

An Automatic Washing Machine.

Problems

The following schedule of rates is in effect in a small-loan company. Complete the table.

PAYMENT SCHEDULE

No.	*Amount of Loan*	*Monthly Payment for 12 Months*	*Cost of Loan for 12 Months*	*Monthly Payment for 15 Months*	*Cost of Loan for 15 Months*	*Monthly Payment for 20 Months*	*Cost of Loan for 20 Months*
1.	$100	$10.07	$	$ 8.40	$	$ 6.75	$
2.	150	15.10		12.60		10.12	
3.	200	20.03		16.69		13.38	
4.	240	23.91		19.90		15.91	
5.	270	26.80		22.28		17.80	
6.	320	31.57		26.22		20.89	
7.	380	37.13		30.78		24.45	
8.	460	44.40		36.70		29.04	
9.	500	48.00		39.63		31.29	
10.	700	65.78		54.06		42.36	

Another Method of Repaying Small Loans

The amount of interest which small-loan companies may charge is limited by state laws. In one state, for example, small-loan companies are permitted to charge 3% a month for loans up to $150, 2% a month for loans from $150 to $300, and ⅔% a month for loans from $300 to $1000.

EXAMPLE. A man borrows $100 from a small-loan company and agrees to pay back $20 a month with interest. How much interest does he pay if he makes each of his five payments on time?

SOLUTION.

First month .... 3% of $100 = $3.00
Second month .... 3% of 80 = 2.40
Third month .... 3% of 60 = 1.80
Fourth month .... 3% of 40 = 1.20
Fifth month .... 3% of 20 = .60
Total interest paid = $9.00

Problems

Work the following problems according to the preceding example, using the rates of interest given above:

1. John Stewart borrows $100 to be paid back at the rate of $10 a month. How much total interest does he pay?

2. Frank Wood makes a loan of $250 payable at $25 a month with interest. How much interest does he pay before the loan is repaid?

3. James Benedict borrows $500 from a small-loan company and agrees to pay it back at the rate of $50 a month with interest. What total interest does he pay?

4. Ed Haskins borrows $200, to be paid back at the rate of $20 a month with interest. When his first payment is due, he is able to pay only the interest and nothing on the principal. His second payment is $40. What total interest does he pay for the loan?

5. Henry Benedict obtains a loan of $600 for 12 months. What is the total amount of money paid to the loan company at the end of the year?

Methods of Repaying Small Loans (Continued)

A loan department offers two types of loans. Both have the same rate—6% interest and 2% carrying charge. In the first type, the charges are added to the amount of the loan. In the second type, the charges are subtracted, in advance, from the amount of the loan.

EXAMPLE. A man borrows $150 for 12 months at the above rates. Find the amount of the monthly payment.

SOLUTION—TYPE 1.

8% of $150 = $ 12.00, amount of charges.
150.00
$162.00, total amount of loan.
$162 ÷ 12 = $ 13.50, amount of monthly payment.

SOLUTION—TYPE 2.

8% of $150 = $ 12.00, amount of charges.
$150 − $12.00 = $138.00, amount of loan.
$138 ÷ 12 = $ 11.50, amount of monthly payment.

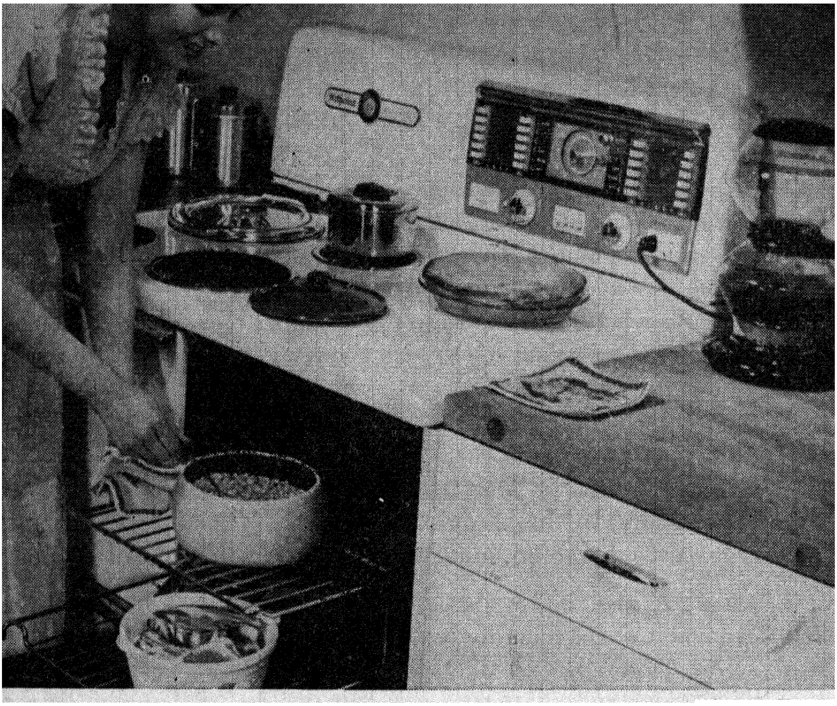
Problems

1. James Green borrows $250 for 12 months. What would he pay in charges under each type of loan?

2. George Drake obtains a loan of $200 under a Type 1 contract for 12 months. What are his monthly payments?

3. Robert Berry borrows $175 for 12 months. (*a*) Find the monthly payment under a Type 1 loan. (*b*) Find the monthly payment under a Type 2 loan.

4. A loan of $400 for 18 months is obtained by Tom Keene under a Type 2 plan. (*a*) What does the loan cost him? (*b*) What is each of his monthly payments?



Electric Range. This stove is in use while it is being paid for.

5. John Poe wishes to borrow $500 for one year under a Type 2 plan. Approximately how much must he borrow in order to have $500?

UNIT 4

True Rate of Interest in Installment Buying and Small Loans

If a person borrowed $100 for one year at 6% interest and at the end of the year paid back $106, the actual cost of his loan would be $6. But if he repays this loan in monthly installments, he has the full use of $100 for only one month and thereafter the use of decreasing amounts. What is the true rate of interest which he actually pays?

Example. What is the true annual rate of interest on a loan of $250 for 12 months payable in equal installments of $24.87?

Solution.

12 × $24.87 = $298.44, amount owed.
250.00, face of loan.
$ 48.44, total amount of interest.

$$\begin{array}{rl} \$298.44, & \text{debt the first month.} \\ \underline{24.87}, & \text{debt the last month.} \\ \$323.31 & \end{array}$$

$$\$323.31 \div 2 = \$161.66, \text{ average debt.}$$

$$\$48.44 \div \$161.66 = 29.9\%, \text{ true annual interest.}$$

Note: In installment buying with down payments, the original amount of the loan minus the down payment plus the interest charges equals the debt owed. Also, if the loan runs for 6 months, the average debt must be multiplied by $\frac{6}{12}$; if for 18 months, by $\frac{18}{12}$.

Problems

1. Find the true annual rate of interest on a loan of $180 for 12 months at $18.08 a month.

2. What is the true annual rate of interest on a loan of $220 payable at the rate of $18.30 for 15 months?

3. Mr. Roberts purchases a refrigerator for $275. He pays $45 down and the rest in 12 equal payments of $22.94. Find his true rate of interest.

4. Mr. Henderson bought a deep freezer for $350 with a down payment of $60. He pays the balance in 18 monthly payments of $20.62 each. What is the true rate of interest?

5. Mr. Jenkins buys a used automobile for $1395. He pays $553.20 down and $61.94 a month for 18 months. Find the true rate of interest.

Chapter Test—Review

1. A used car is marked at $1475. The down payment is $516.20. There are 18 monthly payments of $65.83. What is the actual cost of the car?

2. A used car was advertised with a down payment of $533.20 and 18 payments of $69.94. The cash price was $1595. How much was added to the cost of the car by purchasing on the installment plan?

3. Charles Weaver bought a television set for $239. He paid 15% down, 8% finance charges, and the balance in 12 equal payments. (*a*) What was the amount of the down payment? (*b*) What was the balance owed? (*c*) What was the amount of each monthly payment?

4. Albert Wilson bought an automatic washing machine for $285. He paid 15% in cash and the balance at $23.91 a month for 12 months. How much would he have saved by paying cash for the entire amount?

5. What is the cost of a $340 loan which is to be repaid at the rate of $33.44 a month for 12 months?

6. Michael Vince borrows $200 from a loan company, to be repaid

$20 a month with interest at 2% a month. What is the total amount of interest which he pays?

7. Albert Thomas borrows $225 from a bank which charges him 6% for interest and 1% for insurance. These charges are added to his loan. What is the amount of his monthly payment if he repays the loan in 12 months?

8. Find the true annual rate of interest on a loan of $220 for 12 months at $21.98 a month.

9. Mr. Thomas borrows $300 to be paid back in 18 months, for which he is charged 8% interest. The charge is added to his loan. What is the true annual rate of interest?

10. Mr. Murray purchases a radio for $175. He pays $30 down and the balance at $14.10 for 12 months. Find the true annual rate of interest.

Speed Drills in Fundamentals

Test 9

Add:

1. $768.75
836.59
396.86
985.79
298.85
464.62
645.81
737.92

2. $985.93
388.75
257.88
567.79
365.57
746.78
997.69
846.96

3. $572,892
62,354
789,568
431,225
85,622
41,298
854,777
59,526
238,787
462,685

4. $27\frac{1}{2}$
$115\frac{3}{4}$
$69\frac{7}{8}$
$283\frac{5}{12}$
$19\frac{2}{3}$

5. $34\frac{5}{6}$
$17\frac{3}{4}$
$24\frac{2}{3}$
$48\frac{1}{2}$

6. $36\frac{1}{4}$
$49\frac{3}{4}$
$25\frac{1}{2}$
$53\frac{1}{4}$

7. $41\frac{2}{3}$
$54\frac{1}{4}$
$36\frac{1}{6}$
$29\frac{3}{8}$
$45\frac{1}{6}$

Subtract:

8. 7.8 − 4.9
9. 2.84 − .006
10. .42 − .0025
11. 100 − 6.08
12. 8.14 − 7.356
13. .58 − .015

Change to mixed numbers:

14. $\frac{4}{3}$ **15.** $\frac{18}{12}$ **16.** $\frac{8}{5}$ **17.** $\frac{12}{5}$ **18.** $\frac{9}{4}$

Multiply:

19. 13 ft. 6 in. × 15 ft. 6 in.
20. 12 yd. 2 ft. 9 in. × 5.
21. 3750 × $12.50 per M.
22. $60 \times 1 \times \frac{8}{12} \times 16 \times \frac{1}{1000} \times \$11.75$.

Divide:

23. $62 \div 40\%$
24. $75 \div 12\frac{1}{2}\%$
25. $3300 \div \frac{8}{9}$
26. $\$1000 \div 5\frac{1}{2}$
27. $\$1200 \div 6\frac{3}{4}$
28. $\$150 \div 8\frac{1}{3}$
29. $\$189.60 \div .03$
30. $\$212.80 \div .025$
31. $\$286.25 \div .0025$

Find:

32. $\frac{1}{8}\%$ of $3240 is ____.
33. $\frac{5}{8}\%$ of $2856.80 is ____.
34. 120% of $1575.50 is ____.
35. $1\frac{3}{4}\%$ of 875 is ____.
36. 652 is 6.4% of ____.
37. ____% of 1264 is 325.
38. ____% of 325 is 1264.

Find the decimal equivalent:

39. $\frac{1}{4}\%$
40. $\frac{5}{8}\%$
41. 15 mills
42. 265 mills

Complete:

43. .0825 is equal to ____%.
44. 90 is 150% of ____.
45. ____% of 40 is 65.
46. ____% of 65 is 40.
47. .025 is equivalent to ____%.
48. $116\frac{2}{3}\%$ of 24 is ____.
49. $2\frac{1}{2}\%$ of 17,525 is ____.
50. $1\frac{1}{4}\%$ of 28,750 is ____.

Chapter 14

Automobile Ownership and Operation

About 50 million automobiles, buses, and trucks are registered in this country. Automobiles are not only used for pleasure, but are used in business by doctors, farmers, salesmen, and millions of other people as a means of transportation to their places of employment. Motor buses are used in place of street cars for public conveyances. The trucking industry has expanded to tremendous proportions.

The businesses related to motor transport employ thousands of men. In addition to the actual manufacture of these machines are the businesses which distribute them, service and filling stations, parking lots and garages, auto service shops, motor courts, and roadside stands. Motor vehicles affect the lives of all of us in many ways.

UNIT 1

Purchasing an Automobile

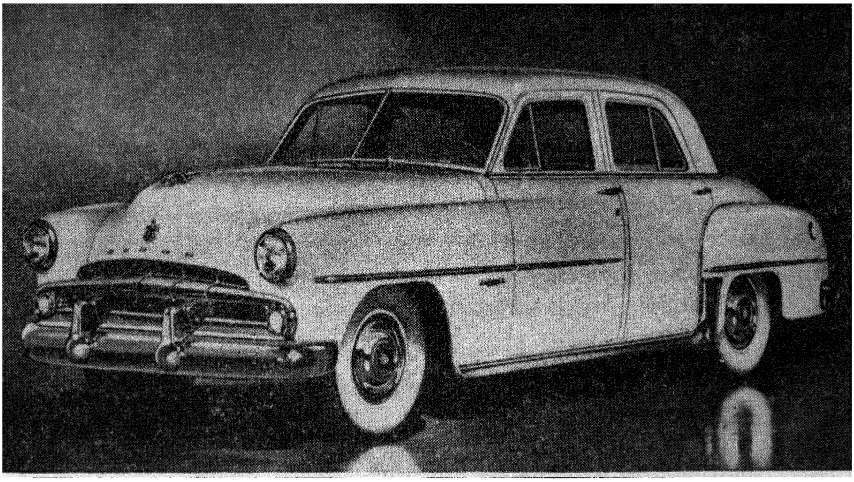
Installment credit used in the purchase of automobiles equals, and in some years exceeds, the installment credit used in the purchase of all other articles combined. A down payment of one-third of the total cost is usually required, and the balance, plus a carrying charge, is made payable in 12 or 18 payments.

The list price, called the *basic price,* quoted on present-day automobiles does not usually include transportation from the factory, federal and state taxes, financing, insurance, or accessories.

Problems

1. Mr. Bailey purchased a new car with a delivered price of $2052. He paid one-third down and the balance in 12 equal monthly payments with interest at 4½%. Find the amount of the monthly payment.

2. Mr. Herbert owed $1500 on a car after making his down payment.



Courtesy Acme Pictures

A Modern Automobile. Buying and operating an automobile constitutes a major part of the average American family's budget.

He paid $91.00 a month for 18 months. How much did it cost Mr. Herbert to finance the loan?

3. Mr. Myers purchased a sedan for $2051.61. This price included taxes and transportation. In addition, he was charged $177.47 for accessories, $156.00 for a special transmission, and $95 for insurance. He paid one-third down and 5% on the balance, which was divided into 12 equal payments. (*a*) What is the balance due after making the down payment? (*b*) What is the amount of each monthly payment?

4. Mr. Trout bought a station wagon with a basic price of $2415.15. He made a down payment of one-third of this amount. The following additional charges were added: transportation, $32.00; federal tax, $192.00; state tax, $80.17; accessories, $202.51. Find: (*a*) the total cost; (*b*) balance due; (*c*) monthly payments including 4% yearly interest for 18 months.

5. Mr. Willard owes a balance of $1078.92 on the purchase of a car, which he repays at the monthly rate of $65.44 for 18 months. Find his true rate of interest.

UNIT 2

Operating an Automobile

The operating expenses for an automobile are divided into two general classes—fixed and running. The fixed expenses consist of such items as depreciation, insurance, and licenses. The running expenses are numerous, including gasoline, oil and grease, tires, and repair bills.

Problems

1. Mr. Bradford paid $2450 for an automobile. After a period of three years he was allowed $1374 on a new car. What was the annual depreciation on his old car?

2. Mr. Preston bought a new car for $1500. He used the car for eight years and finally sold it for $175. (*a*) What was the total depreciation? (*b*) What was the yearly depreciation?

3. Mr. Chase owned an automobile for five years. His yearly costs were as follows: depreciation, $275.00; license fees, $10.00; insurance, $87.50. What were his total fixed expenses for the five years?

4. If Mr. Chase drove 1200 miles per year, what did his total fixed expenses average per mile?

5. A car was driven 2400 miles on a trip during which 200 gallons of gasoline were purchased at an average price of 27¢ per gallon. What was the cost per mile for gasoline for the trip?

6. Mr. Kinney purchased four tires for $20.00 each. He used them for three years before purchasing new ones. During the three years, he drove 8000 miles per year. What was the cost per mile for the four tires during that time?

7. Mr. Johns purchased a new car for $1900. His depreciation the first year amounted to 20%. During that year he spent $76.00 for insurance; $175.00 for gasoline; $60.00 for oil and greasing, and $40.00 for repairs. How much did his car cost him a month?

8. A salesman ran an automobile 18,000 miles in one year. His fixed expenses for the year were $450 and his running expenses averaged 2.9¢ per mile. What was the total yearly cost of operating the automobile?

9. Mr. Vance, his wife, and his two children took a ten-day trip in the family car. Their expenditures were as follows for a 2000-mile trip:

Lodging	$ 90.00
Oil and grease	8.20
Repairs	22.50
Food	165.00
Gasoline	36.45
Incidentals	67.00

(*a*) What was the total cost of the trip? (*b*) What was the average cost per person? (*c*) What was the average cost per day? (*d*) What was the average cost per mile for the car?

10. If a man's fixed and running expenses for his automobile cost him $45 a month and he earns $5000 a year, what per cent of his income does he spend on his car?

UNIT 3

Automobile Insurance

One of the most important of the fixed items of expense for an automobile is the insurance. The cost of the insurance depends not only on the amount and different kinds carried, but on a number of other factors, such as: type of car, cost of car, age of driver, use of car, location, and type of garage.

Types of Insurance

In general, automobile insurance may be divided into two types: the type that protects the owner against loss to his own car, and the type that protects him against loss to others as a result of damage inflicted by his own automobile.

Comprehensive Insurance. As the name suggests, comprehensive insurance covers damage to the owner's car resulting from fire, theft, tornado, and, in fact, everything except losses caused by a collision with another object or by an upset.

Collision Insurance. This type of insurance protects the owner against damage to his own car by collision with another car or an object. It is usually written with deductible clauses, such as $25-deductible, $50-deductible, and $100-deductible. This means that the owner pays these amounts on any one bill and the insurance company pays the rest.

Bodily Injury Insurance. This type of insurance is sometimes known as *personal injury* or *public liability insurance.* It protects the owner against claims of injuries to other persons. It is written in the following classifications: 5/10; 10/20; 20/40; 25/50; and 50/100. Such a fraction, for example, 5/10, means that the limits of payments for injury in any one accident are $5000 for one person or $10,000 for all persons involved in the same accident.

Property Damage Insurance. This insurance pays for damage to property, including automobiles, belonging to persons other than the insured. It is usually written in amounts of $5000 and $10,000.

Because of the great number of classifications and, hence, of rates for private passenger cars and commercial automobiles, it is impracticable to print rates. The chief value of the following problems is to give you a general conception of the cost of automobile insurance.

Problems

1. An automobile is insured for $1400 with comprehensive insurance at 60¢ per $100. What is the amount of the premium?

2. A farmer insures a tractor for $1200. The fire rate is 70¢ per $100, the theft rate is 10¢ per $100, and the windstorm rate is 10¢ per $100. What is the total amount of the premium?

3. A new Diesel truck used for long-distance hauling of gasoline is insured for $3000. The fire rate is 35¢ per $100, the theft rate is 20¢ per $100, and the additional charge added to the fire rate for hauling gasoline is $1.00 per $100. Find the total premium.

4. An owner of an automobile buys $25-deductible collision insurance for $99. He runs into a tree and the repair bill is $25. Would it have been to his advantage to have carried $50-deductible insurance at $67? How much would he have saved?

5. In a certain class, commercial automobiles are charged $75 a year for bodily injury insurance and $73 a year for property damage insurance. Farm trucks are charged 85% of these rates. What would be the total annual premium for a farm truck for both of these coverages?

6. A new light passenger car in a large city has the following rates of insurance: comprehensive, $15.15; $25-deductible collision, $121; 10/20 bodily injury, $41.50; property damage, $5000 limit, $22.00. Find the total yearly premium.

7. A truck insured for $1000 and used for local hauling has the following rates: $3.80 per $100 for fire insurance; $1.90 per $100 for theft insurance; $69 per year for $25-deductible collision insurance; $68 per year for bodily injury insurance; and $66 per year for property damage insurance. What is the total yearly premium?

UNIT 4

Automobile Accidents

AN ALARMING number of persons are killed or injured every year in the United States. The causes are numerous. Speed and reckless driving head the list. Other causes are: carelessness of pedestrians in crossing streets, children playing in the streets, inexperience and youth of drivers, drunkenness, bad road conditions, poor visibility, and mechanical defects. All of these reasons and more are responsible for over one million deaths and many times more accidents that have occurred since this country has used the automobile.

TYPES OF ACCIDENTS RESULTING IN DEATHS AND INJURIES IN ONE YEAR

Collision with	*Persons Killed*	%	*Persons Injured*	%
Pedestrian	10,240		332,300	
Automobile	9,700		768,670	
Horse-drawn vehicle	60		2,800	
Railroad train	1,210		8,020	
Street car	90		16,670	
Other vehicle	220		5,600	
Fixed object	3,100		107,380	
Bicycle	580		42,380	
Non-collision	6,770		178,480	
Miscellaneous	230		8,700	
Total	32,200	100.0	1,471,000	100.0

Problems

Refer to the preceding table for information necessary to answer the following:

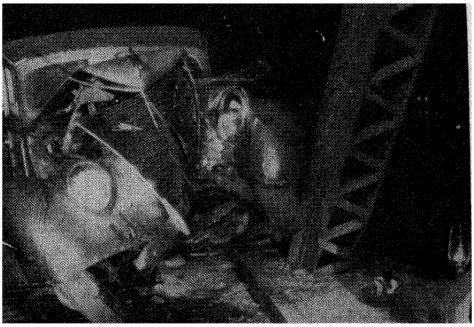
1. In what type of accident are the greatest number of persons killed?

2. In what type of accident are the greatest number of persons injured?

3. What type of collision has the smallest number of deaths? Why?

4. Find the per cent of persons killed to total number killed for each type of accident. Be sure that the total of your per cents equals one hundred.

5. Find the per cent of persons injured to the total number injured for each type of accident. Make the same check as in Problem 4.



An Automobile Accident. Speed, reckless driving, poor lighting, drunkenness, and careless pedestrians are just a few of the causes of accidents like this one.

Stopping an Automobile. Most accidents may be avoided if the driver is able to stop soon enough. Of course, stopping isn't always so easy. First, the driver must think of stopping after he sees the danger. The time that elapses between seeing the danger and starting to apply the brakes is called the *reaction time.* For the average driver, this is $\frac{3}{4}$ of a second. Next, the driver must get his foot on the brake pedal, and, lastly, he must push down on the brakes. All of this takes time. Even after the brakes are applied, the car will go for some distance, depending upon its speed and the condition of the road.

SPEED MILES PER HOUR	STOPPING DISTANCE DRY PAVEMENT	STOPPING DISTANCE WET PAVEMENT	STOPPING DISTANCE ICE OR PACKED SNOW
20 22 FEET	40 FEET 2.4 CAR LENGTHS	50 FEET 2.9 CAR LENGTHS	89 FEET 5.2 CAR LENGTHS
30 33 FEET	77 FEET 4.5 CAR LENGTHS	101 FEET 5.9 CAR LENGTHS	183 FEET 10.8 CAR LENGTHS
40 44 FEET	128 FEET 7.5 CAR LENGTHS	171 FEET 10.0 CAR LENGTHS	311 FEET 18.3 CAR LENGTHS
50 55 FEET	190 FEET 11.2 CAR LENGTHS	258 FEET 15.2 CAR LENGTHS	472 FEET 27.7 CAR LENGTHS
60 66 FEET	263 FEET 15.5 CAR LENGTHS	366 FEET 21.5 CAR LENGTHS	666 FEET 39.2 CAR LENGTHS
70 77 FEET	346 FEET 20.4 CAR LENGTHS	487 FEET 28.6 CAR LENGTHS	897 FEET 52.7 CAR LENGTHS
80 88 FEET	439 FEET 25.8 CAR LENGTHS	623 FEET 36.7 CAR LENGTHS	1158 FEET 68.0 CAR LENGTHS

88 FEET REACTION TIME—Distance car travels between time driver sees danger and starts to apply brakes. (¾ of a second for average driver in an emergency.)

TOTAL STOPPING DISTANCE—Seeing danger, applying brakes and coming to a complete stop.

Courtesy General Motors Corporation

Table of Stopping Distances.

Example. In how many feet can a driver stop his car after applying the brake if he is traveling 50 miles per hour on wet pavement?

SOLUTION.

Total stopping distance........	258 feet
Reaction time................	55 feet
Distance required.............	203 feet

Problems

Refer to the table shown above for the necessary information to solve the following problems.

1. What is the difference in feet of stopping distance for a car driven at 70 miles an hour on dry pavement and for one driven at equal speed on ice?

2. How much farther will a car go before the driver touches the brake if it is moving at 80 miles per hour than one moving at 20 miles per hour? (Reaction time.)

3. According to the relation between stopping distances and the number of car lengths, what is the average car length? Use the figures for the three cars moving at 20 miles per hour.

4. What is the distance required to stop a car when traveling at 60 miles per hour on wet pavement after the driver starts to apply the brakes?

5. If the pavement is dry, what is the maximum speed that could be used in order to stop in time after a driver sees a red traffic light 165 feet away?

6. Two cars are approaching each other from opposite directions on an icy pavement. One is traveling 30 miles per hour and the other 40 miles per hour. If both see each other at exactly the same time, what would be the minimum distance that they must be separated in order to avoid a collision?

Chapter Test—Review

1. Mr. Simmons traded in his old car for a new automobile with a delivered price of $2250. His down payment was one-third of the purchase price. This payment included the $175 allowance for his old car. He paid the balance in 18 monthly equal installments with an annual interest charge of $4\frac{1}{2}\%$. What was the amount of each installment?

2. Mr. James owes a balance of $747.36 on the purchase of a car, which he repays at the monthly rate of $44.30 for 18 months. Find his true annual rate of interest.

3. Mr. Bruce bought a new car for $2200. He used the car for five years and was given a trade-in allowance of $600 on a new car costing $2550. What was his yearly rate of depreciation?

4. Mr. Emery drove his car 8500 miles in one year. During that time

he bought 400 gallons of gasoline at an average cost of 26¢ per gallon. He also purchased 56 quarts of oil at 40¢ per quart. What was the combined cost per mile of gasoline and oil for the year?

5. Mr. Johns purchased a new car for $2350. His depreciation for the first year was 22% of the purchase price. During that year he spent $165 for gasoline, $75 for service on the car, $60 for insurance, $72 for garage rent, and $45 for repairs. How much did his car cost a month to own and operate?

6. Mr. Rogers damages his automobile to the extent of $85. He could have bought $25-deductible collision insurance for $66, $50-deductible for $38, or $100-deductible for $25. In the case of this accident, which insurance would have cost him the least amount of money, and how much?

7. Mr. Lucas carries the following kinds of insurance on his car: comprehensive, $14.00; $50-deductible collision, $48.00; bodily injury, $52.50; property damage, $21.00. What is his car-insurance cost per month?

8. If in a certain city 10,250 persons were injured by automobiles in one year and 125 were killed in the same year, what is the ratio of the number killed to the number injured?

9. If the total stopping distance of a car traveling 40 miles per hour is 128 feet and the reaction distance is 44 feet, how many feet does the car travel while the driver has his foot on the brake?

10. If Mr. Oliver's car costs him $32 a month to operate and he earns $4200 a year, what per cent of his income does he spend on his car?

Speed Drills in Fundamentals

Test 10

Find the total sales of each of the following departments:

1. *Dept.* A	**2.** *Dept.* B	**3.** *Dept.* C	**4.** *Dept.* D
$134.89	$972.46	$697.84	$839.71
879.43	389.72	728.64	724.81
768.97	897.26	148.97	924.82
376.43	976.42	325.71	768.93
289.71	579.21	897.24	647.62
597.61	387.61	972.47	597.69

Add:

5.	**6.**	**7.**	**8.**
$170\frac{5}{6}$	$45\frac{3}{8}$	$19\frac{7}{24}$	$87\frac{1}{2}$
$239\frac{1}{2}$	$25\frac{1}{8}$	$6\frac{5}{12}$	$24\frac{1}{6}$
$184\frac{2}{3}$	$62\frac{2}{3}$	$7\frac{3}{8}$	$18\frac{3}{10}$

Subtract:

9. 6 ft. 8 in.
3 ft. 10 in.

10. 12 pk. 3 qt.
4 pk. 6 qt.

11. 5 hr.
3 hr. 20 min.

12. 1.84 − .39
13. 127.005 − 106.07
14. 100 − 8.29
15. 14.7 − 7.007

Change to improper fractions:

16. $2\frac{3}{5}$ **17.** $8\frac{2}{3}$ **18.** $2\frac{1}{6}$ **19.** $5\frac{3}{4}$ **20.** $6\frac{1}{2}$

Multiply:

21. $6\frac{1}{2} \times 2.65$
22. $\frac{1}{3} \times \frac{5}{7} \times \frac{7}{8}$
23. $\frac{5}{8} \times \frac{4}{5} \times \frac{3}{10}$
24. 1750 × \$.0789
25. \$37.50 × $16\frac{3}{4}$
26. \$58.25 × $63\frac{7}{8}$

Divide:

27. $11\frac{2}{3} \div 4\frac{1}{5}$
28. $4\frac{3}{10} \div 2\frac{3}{5}$
29. $15\frac{3}{4} \div 7\frac{1}{8}$
30. \$48 ÷ 40%
31. \$36 ÷ $37\frac{1}{2}$%
32. \$33 ÷ 60%
33. $96 \div 2\frac{1}{4}$
34. 128 ÷ .075
35. $48 \div 8\frac{3}{4}$

Complete:

36. $27\frac{1}{2}$% of \$60 is ____.
37. 15% of \$1850 is ____.
38. \$2.50 is ____% of \$60.
39. \$26.25 is ____% of \$55.

Find the interest:

	Principal	*Rate*	*Time*
40.	\$ 250	6%	1 yr.
41.	\$ 500	4%	2 yr.
42.	\$1000	$4\frac{1}{2}$%	5 yr.
43.	\$ 750	5%	3 yr.
44.	\$ 800	$2\frac{1}{2}$%	10 yr.
45.	\$ 600	3%	$2\frac{1}{2}$ yr.
46.	\$ 400	6%	60 da.
47.	\$ 250	6%	30 da.
48.	\$ 100	6%	90 da.
49.	\$ 300	3%	60 da.
50.	\$ 500	$4\frac{1}{2}$%	70 da.

Chapter 15

Life Insurance

UNIT 1

Whole Life Policy

A LIFE INSURANCE policy is a written contract between a person, called the *insured person*, and a company, called the *life insurance company*. In exchange for certain payments, called *premiums*, the insurance company agrees to pay a stated amount (the *face* of the policy) when the insured person dies. This payment is made to a second person, who is called the *beneficiary*.

For example, if Mr. John Atkins has a $5000 life insurance policy, then at his death the insurance company will pay $5000 to Mrs. John Atkins or whomever Mr. Atkins names in his policy as his beneficiary.

There are many kinds of insurance policies. One kind is called a "whole-life paid-up at age 85" policy. In this policy, the insured person pays premiums until he is 85. If he dies before he is 85, the premium payments stop and his beneficiary collects the face of the policy. If he lives to be 85, he stops paying premiums at age 85 but his insurance is still in force, so that if he dies at, say, age 90, his beneficiary still collects the face of the policy.

Another type of policy is "whole-life paid-up at age 65," and there is also a "whole-life paid-up at age 60" policy.

The premium payments can be made annually, semiannually,

WHOLE LIFE PAID UP AT 85—$1000

Age	*Annual Premium*	*Semiannual Premium*	*Quarterly Premium*	*Monthly Premium*
20	$20.02	$10.31	$ 5.26	$1.77
30	25.09	12.90	6.50	2.20
40	35.50	17.28	8.80	2.90
50	48.00	24.75	12.60	4.30
60	72.90	37.50	19.18	6.50

quarterly, or monthly. The size of the premium depends upon the age at which the insured person begins paying for his policy.

The table on page 216 shows the amounts of the premiums for various ages for a $1000 policy.

Problems

1. John Armacost is 30 years of age. He takes out a $5000 "whole-life paid-up at 85" policy. What is his annual premium? If he dies at age 60, how much will his beneficiary collect? How much will he have paid to the insurance company?

2. Mr. R. S. Stein is 40 years of age. How much will his annual premium be, for a $10,000 "whole-life paid-up at 85" policy? What would his semiannual premium be? How much per year would he save by paying his premium annually? If he dies at age 90, how much would he have paid in annual premiums?

3. Mr. Ralph Witt takes out a $15,000 policy at age 30. What is his annual premium? If he dies at age 35, how much does his beneficiary collect? How much has he paid to the company?

4. What is the saving per year by annual premiums as compared with monthly premiums, for a person age 20, on a $10,000 policy?

5. Mr. Angus Scott takes out a $20,000 policy at age 40. If he dies at age 50, how much will his beneficiary collect? What is his semiannual premium?

UNIT 2

Limited-Payment Life Policy

In this type of life insurance policy, the premiums are paid only for a certain specified number of years, such as for 5, 10, 15, 20, 25, or 30 years. If the insured person survives the premium-payment period, his payments stop but his insurance is still in force. The full face of the policy goes to the beneficiary when the insured person dies, and premium payments stop at that time.

20-PAYMENT LIFE—$1000

Age	*Annual Premium*	*Semiannual Premium*	*Quarterly Premium*	*Monthly Premium*
20	$32.70	$16.83	$ 8.58	$2.88
30	37.70	19.40	9.90	3.32
40	42.25	23.30	11.88	4.00
50	57.02	29.36	14.96	5.03
60	76.53	39.41	20.08	6.75

Problems

1. Find the annual premium, for a man aged 20, on a $5,000 policy.

2. Mr. Franz takes out a $10,000 policy at age 30. If he dies at age 60, how much has he paid in quarterly premiums? How much does his beneficiary receive? How much would he have paid in semiannual premiums?

3. How much more is the annual premium on a $1000 20-payment life policy than on a $1000 "whole-life paid-up at 85" policy for a man aged 20? For a man aged 60?

4. How much more per year is the monthly premium than the annual premium for a person aged 20? For a person aged 40?

5. Joseph Martinez, age 20, takes out a $3000 policy. What is his semiannual premium? How much has he paid the company at the end of 5 years? 10 years? 15 years? 20 years?

UNIT 3

Endowment Policy

THERE ARE various types of endowment policies. One type provides that the face of the policy is payable to the insured person if living at the end of a specified period of years, or to the beneficiary if the insured person dies prior to that time.

20-YEAR ENDOWMENT—$1000

Age	*Annual Premium*	*Semiannual Premium*	*Quarterly Premium*	*Monthly Premium*
20	$51.43	$26.48	$13.49	$4.54
30	52.14	26.85	13.68	4.60
40	54.90	28.27	14.40	4.84
50	62.12	31.99	16.30	5.48
60	78.28	40.31	20.54	6.91

Problems

1. Miss Alice Wear starts a 20-year endowment policy at age 20, for $5000. What is her annual premium? What does she receive at age 40? What does her beneficiary receive if Miss Wear dies at age 25?

2. Why is the premium for a 20-year endowment larger than that for a "whole-life paid-up at 85" policy and than that for a limited-payment life policy? Why is the premium for a "whole-life paid-up at 85" policy smaller than that for a limited-payment life policy?

3. J. J. O'Brien takes out a $10,000 20-year endowment policy at age 30. What is his monthly premium? How much per year would he save

if he paid his premiums quarterly? What does he receive if he lives to age 50? What would his beneficiary receive if he dies at age 40? How much would he have paid the company in the latter case, in annual premiums?

4. James Benson takes out a $5000 20-year endowment policy at age 20. How much will he receive if he lives to be 40? How much will he have paid to the company in annual premiums?

5. Mr. Arthur Mahoney has three policies—a "whole-life paid-up at 85," a 20-payment life, and a 20-year endowment. He started the first policy at age 20, the second one at age 30, and the third one at age 40. Each is for $10,000, and all premiums are paid annually. If he dies at age 50, how much will his beneficiary receive? How much has he paid to the company?

UNIT 4

Income Endowment Policy

This policy gives the insured person a lifetime monthly income, beginning at a specified date. Premiums are payable during the period selected or until the death of the insured person. The face amount of life insurance is $1200 for each $10 of monthly income. That is, if a person buys a $10-per-month income policy, and he dies, his beneficiary will receive $1200. There are many kinds of these policies, and the one described above is only one of many types.

INCOME ENDOWMENT POLICY—$10 MONTHLY, INCOME BEGINNING AT AGE 60

Age	*Annual Premium*	*Semiannual Premium*
20	$ 41.06	$ 21.14
30	57.98	29.85
40	93.13	47.96
50	199.39	102.68

Problems

1. Matthew Vogel buys an income endowment policy that will pay him a monthly income of $100 beginning at age 60. He is 30 years old when he starts the policy. What is his annual premium? What does his beneficiary receive if he dies at age 40? How much will he have paid the company? How much will he receive from the company if he lives to age 75? How much will he have paid the company?

2. Carl Merritt buys a 20-year endowment for $10,000 at age 20. If he lives to be 40, how much will he receive from the company? If he decides to invest this amount in an income endowment, giving him a monthly income beginning at age 60, how large a monthly income can he provide for?

3. If you could invest $20 per month in an insurance policy, what type of policy would you buy? How large a policy would this provide?

4. Miss Myrtle Chrisman buys an income endowment at age 30. She desires a monthly income of $30 per month beginning at age 60. How much will her semiannual premium be? If she dies at age 35, what will her beneficiary receive?

5. Jack O'Malley buys an income endowment policy that will provide him with a monthly income of $200 per month beginning at age 60. He is 40 years old when he starts the policy. What is his annual premium?

Chapter Test—Review

What is the annual premium on each of the following policies?

1. Whole-life paid-up at 85; $2000; age 30.

2. 20-year endowment; $3000; age 20.

3. Income endowment; $20 monthly income beginning at age 60; age 40.

4. 20-payment life; $2000; age 20.

5. Income endowment; $30 monthly income beginning at age 60; age 30.

6. Mr. David Clark buys a $10,000 20-year endowment policy at age 20. If he lives to age 40, how much will he collect from the insurance company? If he dies at age 30, how much will his beneficiary receive? How much in annual premiums has he paid by age 30?

Speed Drills in Fundamentals

Test 11

Add horizontally:

1. $125 + $14.50 + $95.25 3. $6 + $1.75 + $.24
2. $150 + $17.25 + $205 4. $4.25 + $3.38 + $.23
5. $3.50 + $3.45 + $.21
6. 7.362 + 4.87 + 164.3 + 134 + 2.003 + 12.3
7. 5.7 + 222.832 + 5.004 + .009 + .06
8. 40.6 + 282.5 + 29.057 + .008 + 1.2

Subtract:

9. 128 yd. – $17\frac{1}{2}$ yd. – $15\frac{1}{4}$ yd. – $12\frac{3}{4}$ yd. – $28\frac{7}{8}$ yd.

10. $32.40	11. $65.25	12. $9.87	13. $12.48
6.48	13.06	8.64	9.59

14. 10 bu.	**15.** 6 hr. 20 min.	**16.** 4 lb. 6 oz.
6 bu. 1 pk.	4 hr. 50 min.	2 lb. 8 oz.

Multiply:

17. \$2.85 × 2%
18. \$12.76 × $2\frac{1}{2}$%
19. 11,500 × \$.95 per M
20. 950 × .70 per M
21. 12 ft. × 8 ft. × 12 ft.
22. 15.2 ft. × 14.3 ft.
23. 9.5 × 7 × 25 × \$1.25

Divide:

24. \$1250 ÷ .075.
25. \$2200 ÷ $\frac{8}{9}$
26. \$3250 ÷ 1.125
27. $14\frac{1}{4} \div \frac{3}{4}$
28. 32.62 ÷ .012
29. $.37\frac{1}{2} \div .25$

Find:

30. 60% of \$8575
31. 80% of \$12,550
32. $\frac{1}{2}$% of \$7520
33. \$1375 × 3%

Change to improper fractions:

34. $6\frac{1}{5}$
35. $8\frac{3}{4}$
36. $6\frac{2}{3}$
37. $1\frac{5}{8}$
38. $8\frac{1}{2}$

Change to per cents:

39. .05
40. 6.375
41. .2
42. 6.0
43. $.33\frac{1}{3}$

Solve:

44. \$500 – 6 mo. – 6%
45. \$600 – 4 mo. – 4%
46. \$200 – 3 yrs. – $4\frac{1}{2}$%
47. \$150 – 1 yr. – 3%
48. \$300 – 60 da. – 5%
49. \$800 – 180 da. – 4%
50. \$1000 – $1\frac{1}{2}$ yr. – 5%

Chapter 16

Social Security and Payrolls

UNIT 1

Social Security Taxes

Old Age and Survivor Insurance

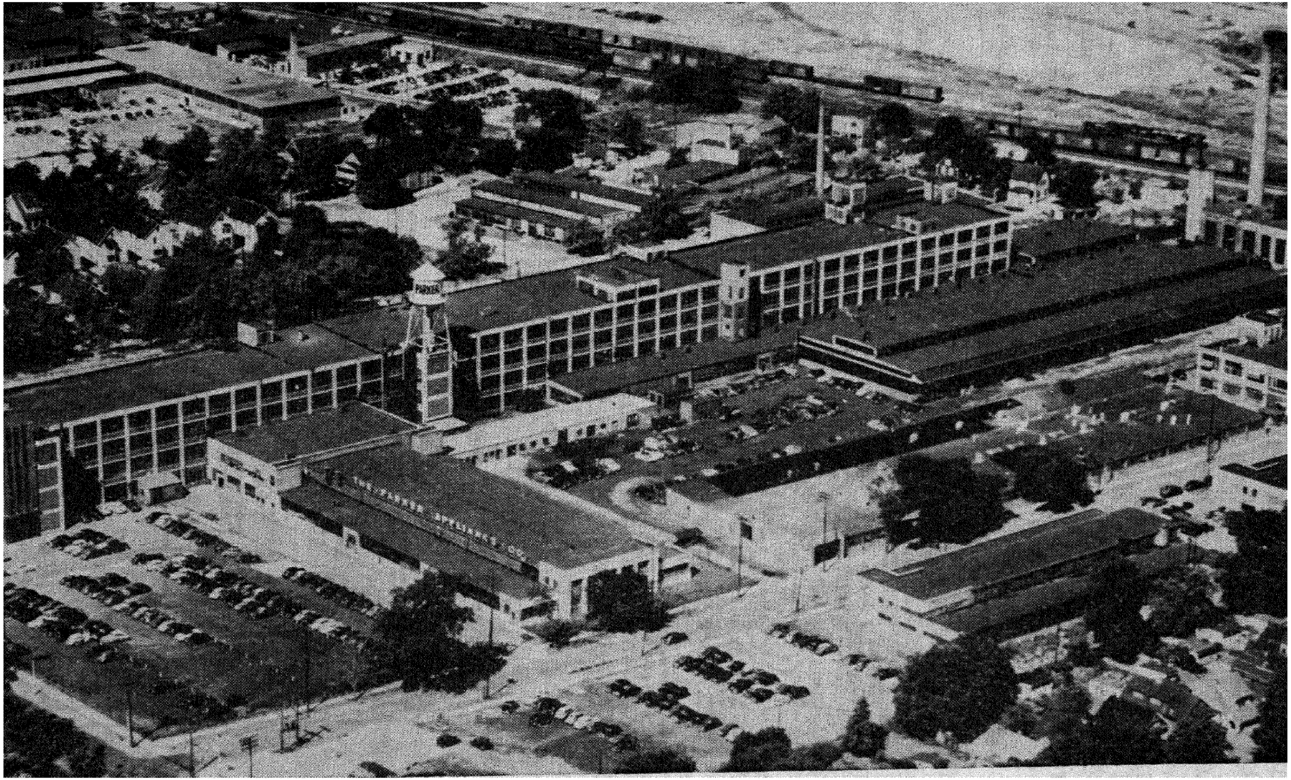
The Social Security Act. The Federal Government passed the Social Security Act in 1935, and amended it in 1939, 1950, 1952, 1954, and 1956. Prior to 1956, all employers were required to pay an excise tax of 2% on wages paid to employees, except in excluded classes of employment. Employees were required to pay the same amount of tax, namely, 2%. The employer deducted this for the government from the salary or wage. These taxes are used to pay retirement (or old-age) benefits to workers and their dependents as well as survivor benefits to dependents of people who die.

Amendments have changed the tax rates to those shown by this table:

Year	*Employer (per cent)*	*Employee (per cent)*	*Self-employed (per cent)*
1957–1959	$2\frac{1}{4}$	$2\frac{1}{4}$	$3\frac{3}{8}$
1960–1964	$2\frac{3}{4}$	$2\frac{3}{4}$	$4\frac{1}{8}$
1965–1969	$3\frac{1}{4}$	$3\frac{1}{4}$	$4\frac{7}{8}$
1970–1974	$3\frac{3}{4}$	$3\frac{3}{4}$	$5\frac{5}{8}$
1975 and after	$4\frac{1}{4}$	$4\frac{1}{4}$	$6\frac{3}{8}$

The maximum amount of salary or self-employment income per year upon which the tax is computed is $4,200. Any amount above $4,200 is not taxed for old-age insurance.

Who Is Insured? With the exceptions noted below, everyone who draws a salary or wages, or earns self-employment income, is fully insured when he reaches 65 (62 for women), or when he dies if he has earned $50 in wages, or $100 in self-employment income, in at least half of the calendar quarters that have passed since 1950 or since he

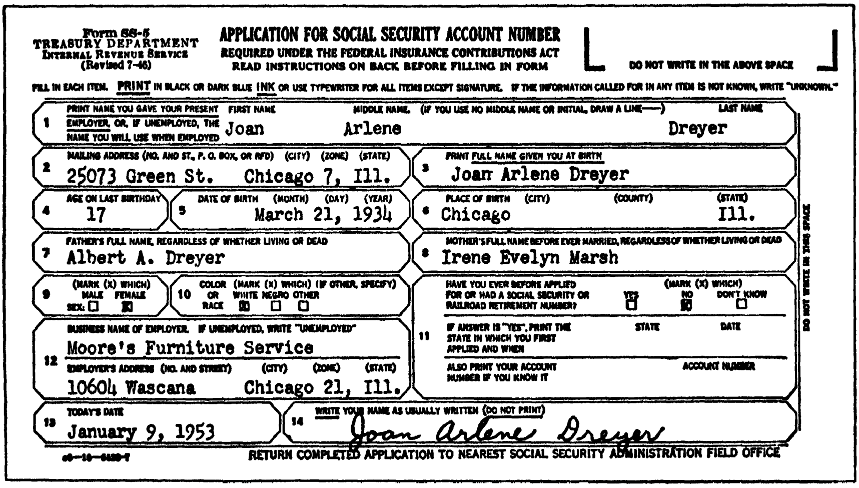


A Large Factory. Hundreds of men are employed in this factory. The payroll department is an important part of this organization.

became 21, provided that he meets the earnings requirement in at least six such quarters. In any case, when the worker has 40 "quarters of coverage," he is fully insured for life. Wages and self-employment income for these tests are specially defined in the Act.

Most employees in private business and industry are covered. Self-employed persons (with the exception of medical doctors and ministers) are also included.

Payment of Tax. Every employer is required to keep accurate records of all wages paid to employees. A tax return must be filed



Form SS-5
TREASURY DEPARTMENT
INTERNAL REVENUE SERVICE
(Revised 7-46)

APPLICATION FOR SOCIAL SECURITY ACCOUNT NUMBER
REQUIRED UNDER THE FEDERAL INSURANCE CONTRIBUTIONS ACT
READ INSTRUCTIONS ON BACK BEFORE FILLING IN FORM

DO NOT WRITE IN THE ABOVE SPACE

FILL IN EACH ITEM. PRINT IN BLACK OR DARK BLUE INK OR USE TYPEWRITER FOR ALL ITEMS EXCEPT SIGNATURE. IF THE INFORMATION CALLED FOR IN ANY ITEM IS NOT KNOWN, WRITE "UNKNOWN."

1 PRINT NAME YOU GAVE YOUR PRESENT EMPLOYER, OR, IF UNEMPLOYED, THE NAME YOU WILL USE WHEN EMPLOYED — FIRST NAME: Joan — MIDDLE NAME. (IF YOU USE NO MIDDLE NAME OR INITIAL, DRAW A LINE——): Arlene — LAST NAME: Dreyer

2 MAILING ADDRESS (NO. AND ST., P. O. BOX, OR RFD) (CITY) (ZONE) (STATE): 25073 Green St. Chicago 7, Ill.

3 PRINT FULL NAME GIVEN YOU AT BIRTH: Joan Arlene Dreyer

4 AGE ON LAST BIRTHDAY: 17

5 DATE OF BIRTH (MONTH) (DAY) (YEAR): March 21, 1934

6 PLACE OF BIRTH (CITY) (COUNTY) (STATE): Chicago Ill.

7 FATHER'S FULL NAME, REGARDLESS OF WHETHER LIVING OR DEAD: Albert A. Dreyer

8 MOTHER'S FULL NAME BEFORE EVER MARRIED, REGARDLESS OF WHETHER LIVING OR DEAD: Irene Evelyn Marsh

9 (MARK (X) WHICH) SEX: MALE ☐ FEMALE ☒

10 COLOR OR RACE (MARK (X) WHICH) (IF OTHER, SPECIFY): WHITE ☒ NEGRO ☐ OTHER ☐

11 HAVE YOU EVER BEFORE APPLIED FOR OR HAD A SOCIAL SECURITY OR RAILROAD RETIREMENT NUMBER? (MARK (X) WHICH) YES ☐ NO ☒ DON'T KNOW ☐

IF ANSWER IS "YES", PRINT THE STATE IN WHICH YOU FIRST APPLIED AND WHEN — STATE — DATE

ALSO PRINT YOUR ACCOUNT NUMBER IF YOU KNOW IT — ACCOUNT NUMBER

12 BUSINESS NAME OF EMPLOYER. IF UNEMPLOYED, WRITE "UNEMPLOYED": Moore's Furniture Service

EMPLOYER'S ADDRESS (NO. AND STREET) (CITY) (ZONE) (STATE): 10604 Wascana Chicago 21, Ill.

13 TODAY'S DATE: January 9, 1953

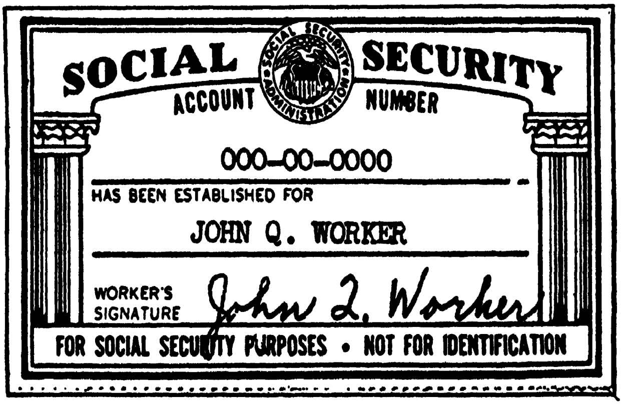
14 WRITE YOUR NAME AS USUALLY WRITTEN (DO NOT PRINT): Joan Arlene Dreyer

DO NOT WRITE IN THIS SPACE

16—16—6480-7

RETURN COMPLETED APPLICATION TO NEAREST SOCIAL SECURITY ADMINISTRATION FIELD OFFICE

Application for Social Security Account Number.



SOCIAL SECURITY
ACCOUNT NUMBER

000-00-0000

HAS BEEN ESTABLISHED FOR

JOHN Q. WORKER

WORKER'S SIGNATURE: John Q. Worker

FOR SOCIAL SECURITY PURPOSES • NOT FOR IDENTIFICATION

SOCIAL SECURITY ADMINISTRATION

Social Security Card.

every calendar quarter on the form provided by the government. Self-employed persons pay their tax at the same time they file their annual income tax return.

Every employer of one or more employees must have an employer identification number. Every employee must obtain, and show his employer, a Social Security number.

Example. During the first quarter of 1957, Paul Reese earned $817.50. What did he contribute to the Federal Social Security Fund? What did his company contribute?

Solution.

$817.50 × .0225 = $18.39 Mr. Reese's deduction
$817.50 × .0225 = $18.39 company's tax contribution

Problems

Consulting the table showing the tax rates, work the following problems:

1. Charles Bender's salary for the second quarter of 1956 was $790.50. How much was deducted from his pay for Social Security?

2. The Porter Manufacturing Company had a payroll for the first quarter of 1957 of $26,872.40. How much did the company contribute to the government as its share for Social Security tax?

3. The Henderson Lumber Company paid to the Federal Government for the Social Security tax for one quarter $120 during 1956. How much was its taxable payroll for the period?

4. The following were the weekly pay checks of five employees of the Economy Sales Company in 1957: $68.40, $72.60, $69.25, $87.77, $42.50. How much was deducted for Social Security taxes in the first four weeks of 1957?

5. Robert Bates earned $5260.50 in 1957 while working in an automobile repair shop. How much did he pay in Social Security taxes?

UNIT 2

Amount of Benefits

The amount of the monthly old-age insurance payment of the worker depends upon his average monthly earnings over a certain period. The time over which average earnings are figured can start with January 1, 1937, or with January 1, 1951.

The 1954 and 1956 amendments to the social security law extended and improved the Old-Age and Survivors Insurance program. Most people will receive higher benefits under the 1954 formula for arriving at average monthly earnings after 1950.

The minimum benefit for an eligible retired individual was raised from $25 to $30 a month and the maximum from $85 to $108.50. Earnings up to $3,600 a year can be counted toward social security for the years 1951 through 1954, and up to $4,200 for 1955 and later years.

The 1954 Formula for Benefits. Under the formula given in the 1954 amendments, the amount of old-age insurance benefit is 55 per cent of the first $110 of the average monthly earnings since 1950, plus 20 per cent of the next $240. The following problems will show how the formula works:

EXAMPLE 1. William Aid upon retirement had average monthly earnings of $260. What will be his monthly Social Security payment?

SOLUTION.

55% of $110 = $ 60.50
$260 − $110 = $150.00
20% of $150 = $ 30.00
$60.50 + $30.00 = $ 90.50, Total Payment.

EXAMPLE 2. Eugene Spenzer's average earnings after 1955 were $6,000 a year. To what monthly benefits was he entitled? (Note: $4,200 yearly equals $350 monthly.)

SOLUTION.

55% of $110 = $ 60.50
$350 − $110 = $240.00, Maximum amount.
20% of $240.00 = $ 48.00
$60.50 + $48.00 = $108.50, Maximum benefits.

Problems

Work the following problems, using the above formula:

1. Rex Hill retired in 1956 at the age of 65. His average monthly income amounted to $320. What is the amount of his old-age insurance?

2. James Gardner, aged 65, applies for old-age benefits, having earned an average of $300 a month for two years after 1954 in covered employment. What benefit amount is he eligible to receive?

3. Larry Reed's total income in covered employment for 52 months after January, 1951 totaled $14,560. If he retires, what will be his monthly Social Security benefit?

4. William Lawrence earned $14,400 in covered employment during 60 months after January, 1951. What will be his monthly old-age insurance amount?

5. Louis Mack earned an average of $375 a month in covered employment before retirement during the three-year period following 1950. Find his monthly Social Security payment.

UNIT 3

Monthly Family Payments

The amount of the worker's old-age insurance benefit determines the amount payable to his dependents. The following table shows how each dependent's payment is figured:

Monthly Payment to	*Part of Wage Earner's Benefit*
Wife (65 or over)	One-half
Husband (over 65*)	One-half
Child (under 18) upon retirement of wage earner	One-half
Widow (62 or over)	Three-fourths
Widower (over 65)	Three-fourths
Child (under 18) after death of wage earner	One-half, plus an additional fourth divided by the number of children
Widow, or divorced wife, supporting child of wage earner, after death of wage earner	Three-fourths
Parent (over 65) after death of wage earner	Three-fourths

---

* Note: Women may get *reduced* benefits starting at age 62.

The total monthly payments to one family cannot be more than 80 per cent of the average earnings or more than $200. If family payments as figured would be more than either of these amounts, each dependent's payment is reduced to bring the total down to the maximum amount payable.

After a death, the widow or widower may be entitled to a lump-sum death benefit as much as three times the worker's monthly benefit, but not more than $255.00.

EXAMPLE 1. John Watson's average earnings were $200. Therefore, his retirement benefit is $78.50. He has a wife and child, both eligible for supplementary benefits. What will be the maximum family payment?

SOLUTION.

$\frac{1}{2}$ of \$78.50 = \$ 39.25, benefit for wife
$\frac{1}{2}$ of \$78.50 = \$ 39.25, benefit for child
\$ 78.50, benefit for John
\$157.00, Total benefits.

(Note: 80 per cent of $200 = $160.00. So John and his family will receive the entire amount.)

Example 2. James Otis, at his death, was receiving $82.50 a month in old-age insurance benefits. What monthly benefit payment will his widow receive?

Solution.

$$\tfrac{3}{4} \text{ of } \$82.50 = \$61.88$$

Problems

Work the following problems, using the above information (assume all persons mentioned are eligible for benefits):

1. Joseph Keller's average earnings were $158.00. He has a wife and one child under 18. What will be the total benefits for the entire family?

2. The average earnings of Adam Marshall were $100 a month. He has a wife and one child under 18. How much will the family receive in benefits?

3. Herbert Harper's average earnings were $250. His retirement payment is $88.50. He has a wife 65 years of age. What will be the total benefits?

4. William Beck was eligible to receive $68.50 upon retirement. What were his average earnings?

5. Samuel Rhodes drew $68 a month in retirement payments. What will his widow receive in monthly payments?

6. Martin Monroe retired with average earnings of $240.00. He has a wife and one child under 18. What are the total family benefits?

7. Edwin Burrows had a retirement payment of $70. After his death, his widow received a lump-sum benefit. How much did she receive?

8. When Otis Bailey died, he had average earnings of $220. How much did his widow, who was 66, receive monthly after his death?

9. Charles McHugh at the time of his retirement averaged $260 earnings. He had no dependents. What did he receive in benefits?

10. James Jackson averaged $350 monthly at his retirement. His wife is his only dependent. What are the total monthly benefits?

UNIT 4

Unemployment Insurance

Unemployment Insurance Defined. As the name implies, *unemployment insurance* is protection to a worker for loss of a job. As each state makes its own regulations, the conditions and amounts of payments vary. In general, the amount of the benefit depends upon the wages earned. Limitations are also placed on the time when payment of benefits begins after loss of a job and on the number of weeks they will be paid. Other conditions are the length of time a worker stays on one job and the reasons for loss of a job.

A State-Federal System. The Social Security Act and the Federal Unemployment Tax Act set up certain minimum specifications for the payment of unemployment insurance. As noted in the preceding paragraph, each state enacts its own unemployment insurance law and administers its own program. Benefits are paid through state-operated and controlled public employment offices.

Tax on Employers. The Federal Government levies a 3% tax on the first $3000 of wages of each employee of employers who employ four or more persons in nonexempt employment on each of 20 or more days per year. Employers are allowed a credit of up to 90% of the federal tax for taxes paid to a state unemployment insurance fund. The balance is sent to the Federal Government once a year. As 90% of 3% is 2.7%, most states have established 2.7% as their rate. Where the regular state rate is 2.7% but the employer is required to pay only a smaller amount because of a merit rating, he is still entitled to the same credit against his federal tax.

EXAMPLE. An employer's total payroll is $100,000. How much does he pay to the Federal Government and how much to the state?

SOLUTION.

$100,000 × .003 = $ 300 paid to the Federal Government.
$100,000 × .027 = $2700 paid to the state.

Problems

(Assume in all cases that the employer is covered by the state and/or federal laws and that the state rate is 2.7%.)

1. The Empire Manufacturing Company had a weekly payroll of $1250. Compute the amounts of unemployment insurance tax paid at the end of the year (*a*) to the Federal Government and (*b*) to the state fund.

2. The Atlas Department Store has the following weekly payroll for its employees at the beginning of 1957: *A* – $45.00; *B* – $52.50; *C* – $39.50; *D* – $22.75; *E* – $78.00. What is the unemployment tax contribution to the state for one month?

3. The Broadway Sales Company's quarterly reports of wages are as follows:

First quarter..........	$1850.25
Second quarter........	$2285.50
Third quarter.........	$1960.75
Fourth quarter........	$2435.00

Compute the total Federal and state unemployment tax for the year.

4. The General Chemical Company paid to the Federal Government $55.11 for the unemployment tax for one year. What was the yearly payroll of the company?

5. How much did the General Chemical Company contribute to the state for the same year?

Extent of Coverage. In general the same types of employment are covered for the unemployment insurance program as for the old-age benefits, although the state law may cover slightly different occupations than the federal law. The federal law does not cover self-employed persons. The number of beneficiaries varies widely in the different states. Some idea of the number, the average number of weeks of the benefits drawn, and the average weekly benefits may be obtained from the following problems.

Problems

1. In one year the state of Michigan paid $82,853,000 in unemployment benefits to 334,333 persons. What was the average benefit for the year which each worker received?

2. If the average duration of benefits drawn in the state of Michigan for the same year was 10.5 weeks, what was the average weekly benefit?

3. In California in a certain year 689,818 persons received unemployment compensation. The total number of weeks was 8,991,244. What was the average number of weeks for which the workers drew unemployment benefits?

4. In Tennessee in a certain year the average number of weeks in which benefits were drawn was 14.0. The average weekly benefits were $14.98. What was the average amount received during that year by each person in unemployment benefits?

5. Iowa paid, in one year, $6,599,000 in unemployment benefits. This amount was received by 35,401 persons. What was the average yearly amount paid to each person?

UNIT 5

Payroll Accounting

Payrolls and the Federal Government

Because of the requirements of the Federal Government concerning income taxes, old-age benefits, and unemployment compensation, the keeping of payroll records has become very important to the employer.

Business firms must keep accurate records of the name, address, and Social Security number of each employee; the amount paid for and dates of services; the amounts of withholding taxes; old-age benefits for each employee; and the amount of money deducted for state unemployment compensation.

In addition, the payroll department must keep records of other deductions for group life insurance, hospitalization insurance, community fund, union dues, retirement plans, and purchase of government bonds. In fact, so numerous have become the deductions of payrolls, that a new term, "take-home pay," has been coined.

Methods of Payment

Wages are computed in many different ways. Time wages may be figured hourly, weekly, semi-monthly, monthly, and annually. Also, employees are paid by piecework, commission, bonus, and profit sharing.

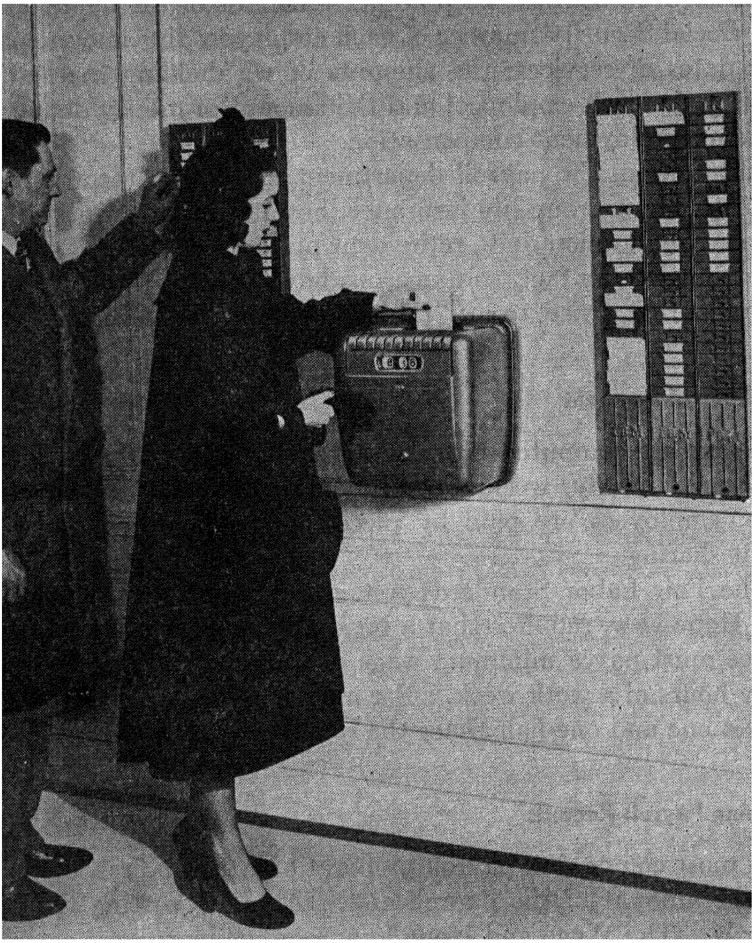
The Fair Labor Standards Act, commonly known as the Wage and Hour Law, requires that a business engaged in interstate commerce must pay a minimum wage of 75 cents an hour for the first forty hours of a work week. For any time beyond forty hours, the rate is one and one-half times the regular hourly rate.

Keeping Payroll Records

In most companies, payroll preparation consists first, of calculating the amount of the payroll and, second, of writing the payroll records. The Wage and Hour Law requires businesses covered by the Act to keep a detailed and complete record.

Time Cards

The most common method of keeping a record of time worked by each employee is the use of time clocks such as that shown in the illustration. Time clocks are used in practically all factories, stores, and large public institutions and in many small businesses. The machine prints on the time card when the employee reports to work, when he leaves, and the time he takes for lunch. From these cards are computed the hours worked by each employee, and the payroll is made up from these figures.



Time Clock in Use.

Payment by Currency

Firms which pay their employees in cash instead of by check must follow a different procedure. After the bookkeeper has computed each man's pay, and then the total payroll, he must arrange for the withdrawal of cash from the bank. Naturally, the money must be so divided that there will be the proper bills and coins to pay each man the exact amount due him. Therefore, the bookkeeper prepares a form showing the denominations necessary for each man's wages. This form, known as a *currency breakup,* or *change memorandum,* is illustrated on the opposite page.

Week Ending *Sept. 10*

No. 3

Name *Cossey, H.*

Position *Stitcher*

Morning In	*Noon Out*	*Noon In*	*Night Out*	*Extra In*	*Extra Out*	*Hours Worked*
M 8:27	M 12:30	M 1:25	M 5:32			8
T 8:29	T 12:29	T 1:31	T 5:35			8
W 8:31	W 12:28	W 1:32	W 5:35			8
T 8:30	T 12:31	T 1:28	T 5:30			8
F 8:38	F 12:30	F 1:30	F 5:30			8

Total Time *40* hours

Rate *$1.10 per hour*

Total Wage *$44*

TIME CARD

CENTURY SHOE MANUFACTURING COMPANY

CHANGE MEMORANDUM

No.	*Name*	*Amount*	*$20*	*$10*	*$5*	*$1*	*50¢*	*25¢*	*10¢*	*5¢*	*1¢*
1	Adams, C.	$ 43.76	2			3	1	1			1
2	Baker, J.	47.72	2		1	2	1		2		2
3	Cossey, H.	43.76	2			3	1	1			1
4	Daniels, J.	43.76	2			3	1	1			1
5	Evans, A.	41.38	2			1		1	1		3
6	Fowler, T.	49.70	2		1	4	1		2		
7	Grant, G.	50.10	2	1					1		
8	Harper, W.	41.38	2			1		1	1		3
9	Moore, G.	39.30	1	1	1	4		1		1	
	Total	$400.86	17	2	3	21	5	6	7	1	11

CHANGE MEMORANDUM

The bookkeeper next lists the totals from the change memorandum on a *payroll slip*, an example of which is shown below. This form is presented to the bank teller and gives him exact information as to how the payroll is to be broken up.

EXCHANGE NATIONAL BANK
PAYROLL SLIP
Currency Wanted by
Century Shoe Manufacturing Company

Denomination	*Number*	*Amount*
Twenties	17	$340.00
Tens	2	20.00
Fives	3	15.00
Ones	21	21.00
Halves	5	2.50
Quarters	6	1.50
Dimes	7	.70
Nickels	1	.05
Pennies	11	.11
Total		$400.86

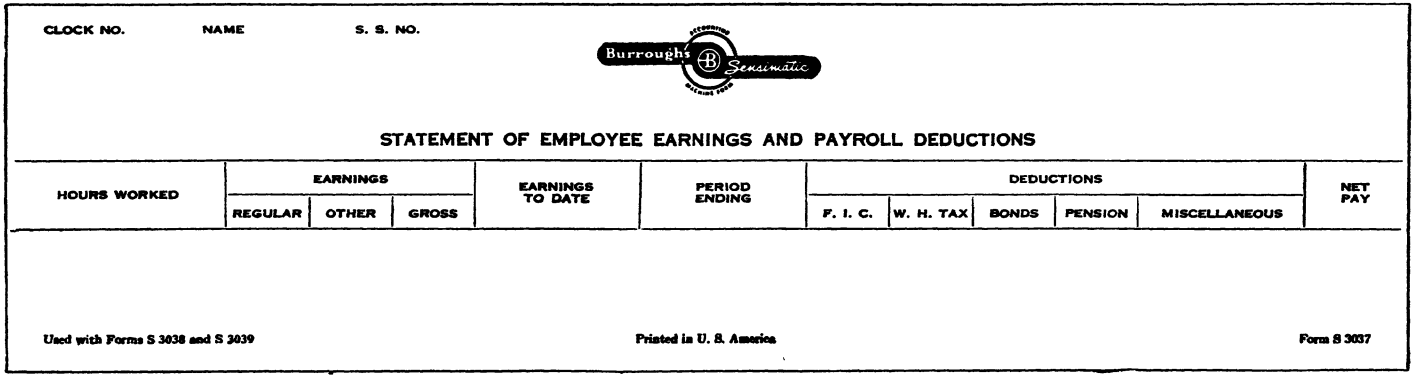
PAYROLL SLIP

The bank teller, however, will not turn over the cash to the person who presents the payroll slip, since it is not an authorization. A check signed by the proper official therefore accompanies the payroll slip. An example of a payroll check follows:

EXCHANGE NATIONAL BANK
NEW YORK, *Sept.* 10, 19—
PAY TO THE
ORDER OF *Payroll* - $400 $\frac{86}{100}$
Four Hundred and $\frac{86}{100}$ - DOLLARS
CENTURY SHOE MANUFACTURING COMPANY
Joseph Duval TREASURER

PAYROLL CHECK

When the money is brought back from the bank, the payroll cashier or the bookkeeper inserts it in pay envelopes, each of which



CLOCK NO. NAME S. S. NO.

Burroughs Sensimatic

STATEMENT OF EMPLOYEE EARNINGS AND PAYROLL DEDUCTIONS

HOURS WORKED	EARNINGS			EARNINGS TO DATE	PERIOD ENDING	DEDUCTIONS					NET PAY
	REGULAR	OTHER	GROSS			F. I. C.	W. H. TAX	BONDS	PENSION	MISCELLANEOUS	

Used with Forms S 3038 and S 3039 Printed in U. S. America Form S 3037

Payroll Check.

usually has an attached receipt. This receipt is signed by the employee when he is paid, and it is then detached from the envelope and filed by the office.

No. 1 Week Ending 1/10

Name C. Adams

Regular Hours				
AMOUNT EARNED			46	00
Fed. Old Age Tax	1	04		
Fed. Withholding Tax	9	30		
Union Dues	2	50		
Company Loan	4	60		
Total Deductions	17	44	17	44
NET AMOUNT DUE			28	56

Received in full for services to date

SIGNED

KEEP THIS ENVELOPE. IT IS YOUR RECEIPT

PAY ENVELOPE USED AS A RECEIPT

Keeping the Payroll Register

The payroll register, sometimes called a *payroll journal* or a *payroll report,* is a form used to summarize the individual's wages for each pay period. Large businesses use a separate sheet for each department or branch. Many registers give detailed information on the number of hours worked each day. Sometimes separate time records are kept to assemble this information.

Time Wages

Most wages and salaries are paid on the basis of the time worked. Base pay is figured on the first 40 hours in a work week. Any hours over 40 are paid for at the rate of one and one-half times the regular hourly rate.

Example. James Wolf worked 44 hours in one week. His pay was $1.40 an hour. His deductions were as follows: Old Age Benefits (O. A. B.), $1.45; Withholding tax (Federal Income Tax), $7.80; Hospitalization, $1.00; Community fund, $1.50. Find his net wages.

Solution.

$$\begin{aligned} 40 \times \$1.40 &= \$56.00\text{, regular time.} \\ 4 \times \$2.10 &= \underline{8.40}\text{, overtime.} \\ & \$64.40\text{, gross wages,} \end{aligned}$$

Deductions:

O. A. B.	$ 1.45	
Withholding tax	7.80	
Hospitalization	1.00	
Community fund	1.50	
	$11.75	11.75, total deductions.
		$52.65, net wages.

Problems

A PAYROLL REGISTER (TIME WAGES)

1. Complete the payroll register on page 238, showing the total hours worked, earnings, total deductions, and net pay. All hours worked over 40 will be counted at time and a half.

2. Prepare a payroll register like that in Problem 1 and complete it with the following information:

Francis, R.: 44 hours; $1.20 per hour; Deductions—O. A. B., $1.24; Withholding tax, $6.40; Union dues, $2.50; Misc., $1.50.

Harper, H.: 40 hours, 90¢ per hour; Deductions—O. A. B., 81¢; Withholding tax, $3.50; Union dues, $2.50; Misc., none.

Hold, E.: 42 hours; $1.25 per hour; Deductions—O. A. B., $1.21; Withholding tax, $6.10; Union dues, $2.50; Misc., $1.25.

James, W.: 40 hours; $1.65 per hour; Deductions—O. A. B., $1.49; Withholding tax, $8.10; Union dues, $2.50; Misc., none.

Koenig, F.: 36 hours; $1.90 per hour; Deductions—O. A. B., $1.54; Withholding tax, $8.40; Union dues, $2.50; Misc., $1.50.

Novak, J.: 46 hours; $1.10 per hour; Deductions—O. A. B., $1.21; Withholding tax, $6.20; Union dues, $2.50; Misc., none.

Schmidt, L.: 40 hours; $1.50 per hour; Deductions—O. A. B., $1.35; Withholding tax, $7.20; Union dues, $2.50; Misc., $1.25.

Volk, R.: 42 hours; $1.60 per hour; Deductions—O. A. B., $1.55; Withholding tax, $8.40; Union dues, $2.50; Misc., $1.50.

3. Prepare a change memorandum and a payroll slip for Problem 2.

The Piecework Method of Payment

Under the piecework method, the employee is paid according to the amount he produces and not by the number of hours which he works. In other words, his wages increase as his production is speeded up.

Example. James Morton worked on a press in a foundry and was paid by the piece. The following was his record of pieces completed for one week: M., 112; T., 126; W., 118; T., 130; F., 110. He was paid at the

Problem 1. (See page 237.)

PAYROLL REGISTER

FOR WEEK ENDING January 11 DATE OF PAYMENT January 15

EMPLOYEE'S NAME	HOURS WORKED			RATE		EARNINGS			DEDUCTIONS						NET PAY	
	REG.	O T	TOT. AL.	HR.	WEEK	REG	O. T.	TOTAL	O A.B.	INC. TAX WITH.	GROUP INS.	HOSP.	OTHER	TOTAL	AMOUNT	CHECK NO.
Dickson, J	40	4		1.40		56 00	8 40	64 40	1 45	9 70	2 00	1 25	3 00	17 40	47 00	
Holland, C	40			1.20					1 08	7 10	2 00	1 25	2 75			
Ingram, C	40	4		90					93	6 20		1 25	2 10			
Jameson, H	33			1.65					1 41	7 70	2 00		1 65			
Knoules, F	40	6		1.40					1 54	10 30	2 00	1 25				
Kren, R	40			1.25					1 13	7 50	2 00	1 25	2 50			
McQuay, E	40	2		1.30					1 26	8 30	2 00	1 25	1 25			
Nesler, R	36			1.80					1 46	9 70	2 00	1 25				
Peterson, B	40	1		1.40					1 31	8 70	2 00	1 25	1 00			
Schwartz, H	40	4		1.40					1 45	9 70	2 00	1 25	2 20			
TOTAL																

Payroll Register

rate of 15¢ per piece. His deductions were as follows: O. A. B., $2.01; Withholding tax, $11.40; Union dues, $2.75; Old Age Benefits, 2¼% of gross pay; and Miscellaneous, $1.25. Compute his net pay.

SOLUTION.

No. of Pieces	
M.	112
T.	126
W.	118
T.	130
F.	110
Total. . .	596

Deductions	
O. A. B.	$ 2.01
Withholding tax.	11.40
Union dues.	2.75
Misc.	1.25
Total.	$17.41

596 × .15 = $89.40, gross pay.
Less deductions 17.41
$71.99, net pay.

Problems

1. Complete the following payroll, filling in total pieces, gross pay, O. A. B., total deductions, and net pay.

Period Ending
2/18

PAYROLL REGISTER

Name	*No. of Pieces*						*Total Pieces*	*Rate*	*Gross Pay*	*Deductions*					*Total Deductions*	*Net Pay*
	M	*T*	*W*	*T*	*F*	*S*				*O.A.B.*	*With-holding*	*Ins.*	*Dues*	*Misc.*		
Burns, Wm.	28	18	22	31	27		126	.60	75.60	1.70	7.40	.75	1.25	1.50	12.60	63.00
Gray, H.	19	30	24	25	26			.55			5.90	.75	1.25	.60		
Hawk, E.	31	32	33	36	38			.50			5.30	.75	1.25			
Kelly, N.	27	19	23	30	28			.60			6.60	.75	1.25	.85		
Lund, O.	24	33	40	31	27			.50			4.90	.75	1.25	1.35		
Mix, M.	31	30	29	28	27			.55			5.40	.75	1.25			
Voth, R.	27	28	31	24	25			.60			7.70	.75	1.25	1.50		
Wise, S.	19	28	32	24	26			.45			4.60	.75	1.25	2.00		

2. Construct a payroll register like the one above. Using the following information, complete the register as in Problem 1. Include Old Age Benefits.

Gaye, F.: M., 115; T., 126; W., 114; T., 118; F., 120; Rate, 12¢; Withholding tax, $7.10; Insurance, $1.25; Union dues, $2.00; Misc., $1.50.
Ludlow, E.: M., 60; T., 62; W., 59; T., 71; F., 55; Rate, 22¢; Withholding tax, $7.50; Insurance, $1.25; Union dues, $2.00; Misc., none.
Meeks, J.: M., 82; T., 76; W., 80; T., 75; F., 78; Rate, 16¢; Withholding tax, $5.60; Insurance, $1.25; Union dues, $2.00; Misc., $1.50.
Opper, F.: M., 65; T., 64; W., 70; T., 75; F., 68; Rate, 14¢; Withholding tax, $6.20; Insurance, $1.75; Union dues, $2.00; Misc., none.
Scott, C.: M., 102; T., 98; W., 95; T., 98; F., 105; Rate, 10¢; Withholding tax, $7.30; Insurance, none; Union dues, $2.00; Misc., none.
Stephens, R.: M., 68; T., 70; W., 75; T., 65; F., 60; Rate, 20¢; Withholding tax, $5.30; Insurance, $1.25; Union dues, $2.00; Misc., $1.25.

Payment by Check

When companies pay by check, the amount of the wages is computed from the payroll register just as it is when payment is by cash. Most checks are accompanied by a receipt or a stub showing the various deductions. The employee removes this receipt or stub before cashing the check. He should keep this information to check with the income tax withholding receipt given him at the end of the year.

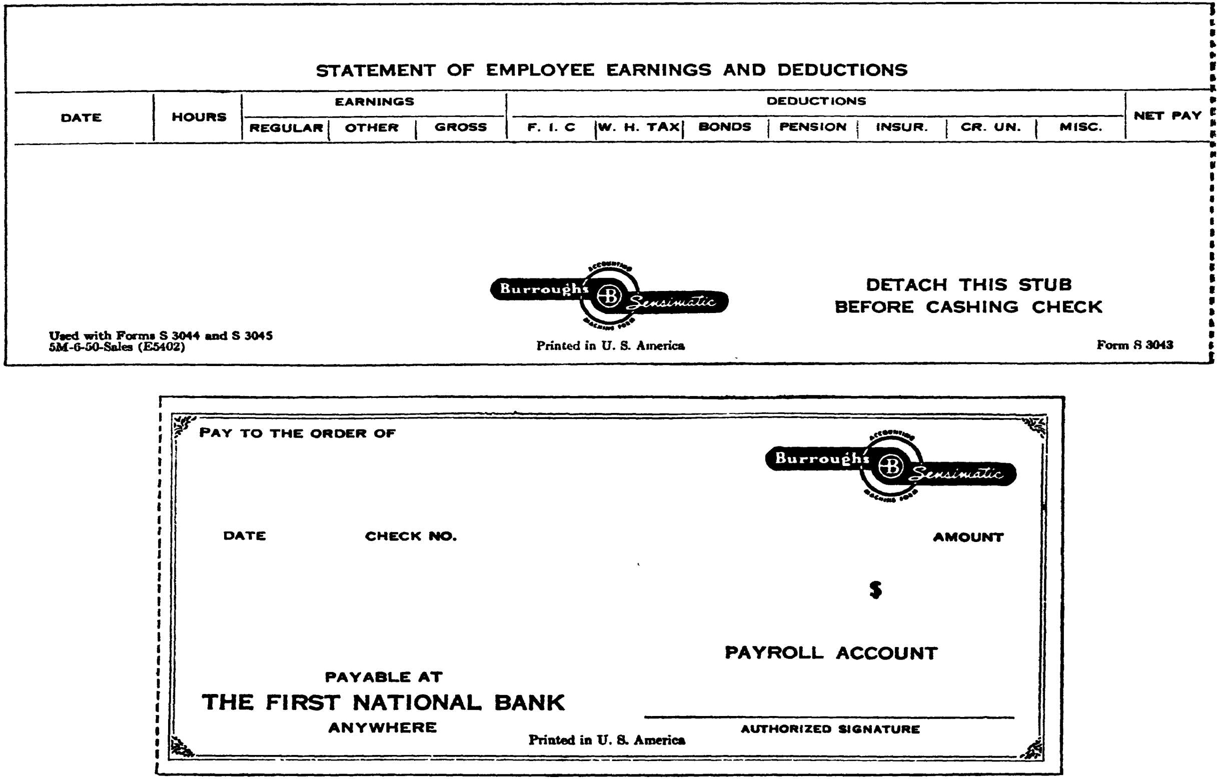
Examine the sample check on the opposite page. Can you name other deductions not shown on this check?

UNIT 6

Commission and Salary

Some sales are made through customers' sending in or telephoning orders, but in the vast majority of cases sales are made by salesmen, who are employed for just such a purpose. How are these individuals paid for their work?

There is no one way of payment. Some salesmen are paid on a *straight-salary basis*, with no dependence on the amount or number of sales they may make. This method is open to the objection that under it there is little incentive for the salesman to increase his sales, since there is no additional reward in view. The tendency, therefore, is to pay salesmen on a *commission basis* or a *commission-and-salary basis*. This basis, which causes the salesman's income to rise as he sells more and to fall as he sells less, encourages him to put forth his best efforts at all times. Let us examine several of these methods in detail.



STATEMENT OF EMPLOYEE EARNINGS AND DEDUCTIONS

DATE	HOURS	EARNINGS			DEDUCTIONS							NET PAY
		REGULAR	OTHER	GROSS	F. I. C	W. H. TAX	BONDS	PENSION	INSUR.	CR. UN.	MISC.	

DETACH THIS STUB
BEFORE CASHING CHECK

Used with Forms S 3044 and S 3045
5M-6-50-Sales (E5402)

Printed in U. S. America

Form S 3043

PAY TO THE ORDER OF

DATE CHECK NO. AMOUNT

$

PAYROLL ACCOUNT

PAYABLE AT
THE FIRST NATIONAL BANK
ANYWHERE

Printed in U. S. America

AUTHORIZED SIGNATURE

Payroll Check with Stub Showing Deductions.

Percentage-of-Sales Basis

EXAMPLE 1. Charles Morgan, a salesman, works on a straight 5% commission basis. His sales during a certain period are $2500. How much has he earned?

SOLUTION. Sales, $2500
5% of $2500 = $125, commission earned.

Quantity-Sold Basis

EXAMPLE 2. Frank Jones, a salesman, works on a commission basis, receiving $15 for each sale he makes. He makes 12 sales. What is his income?

SOLUTION. Commission on 1 sale, $15
$15 × 12 = $180, commission on 12 sales.

Salary-and-Commission Basis

EXAMPLE 3. William Conlon, a salesman, is employed on a salary-and-commission basis. He receives a salary of $50 a week plus a commission of 3% of his sales. During a 4-week period, his sales amounted to $3550. What was his income for the 4 weeks?

SOLUTION. $3550 × .03 = $106.50, commission.
$50 × 4 = 200.00, salary.
$306.50, total income.

Another type of payment on the commission basis provides for an increase in the rate when sales go beyond a certain point.

EXAMPLE 4. Robert Prince, a salesman, received 8% on all sales. If his sales went beyond $2500 a month, for all above that figure he would receive an additional commission of 2%. What would his income be on monthly sales of $3500?

SOLUTION.
$3500 × .08 = $280, 8% commission.
$1000 × .02 = $20, 2% commission on excess sales over $2500.
$280 + $20 = $300, total income.

This type has another variation.

EXAMPLE 5. Frederick Mann, a salesman, receives a salary of $55 a week. If his sales go above $2000 a week, he will receive a commission of 5% on all above that amount. Sales total $1850 for the first week and $2450 for the second week. What is his total income for the 2 weeks?

SOLUTION.
$2450 − $2000 = $450, excess during second week.
$55 × 2 = $110, salary for 2 wk.
$450 × .05 = $22.50, commission.
$110 + $22.50 = $132.50, total income for 2 wk.

Problems

GROUP 1

1. Jack Stewart sold $600 worth of ladies' hosiery. If he was paid a commission of 7½%, how much did he receive?

2. John Adams sold 40 desk lamps at $4.50 each. How much did he earn if his commission was 2½%?

3. Allen Bellows sold magazines for 20¢ each. If he was paid 6¢ for each magazine he sold, what per cent commission did he receive?

4. A real estate agent sold a plot of land for $9000. If he received $450 commission, what per cent commission was he paid?

5. Mr. Bates, who works in the men's department of A. B. Tracy and Company, is paid $50 per week plus a commission of 5% on all he sells over $500. If he sold $1100 worth of goods in 1 week, how much did Mr. Bates receive in commission? How much was his total income?

GROUP 2

Suggestion: Before starting actual solutions, go through the problems one at a time and give estimated reasonable results.

1. Mr. White sold 125 doz. ladies' blouses at $29.25 per dozen. Mr. White's commission is 4%. How much did he receive?

2. An agent sold 1510 cases of bottled soda to retail stores. The price of the product is 85¢ per case. Determine the amount of the agent's commission if the rate of commission is 5%.

3. Mr. Koch, an agent, sold ladies' hose for $792. Mr. Koch charged 4½% for his services and $23.25 for traveling expenses. How much did Mr. Koch receive?

4. The Livingston Manufacturing Company engaged Mr. Kane as a salesman and agreed to pay him a commission of 3½%. His sales during the first 3 weeks were $1196.10, $1398.25, and $1285.43. How much was Mr. Kane's commission each week?

5. H. B. Wilson accepted a position as salesman at a monthly salary of $300, plus a 6% commission on all sales over $2000 a month. His sales amounted to $1950 in March, $3250 in April, and $3375 in May. What was the total commission that Wilson was entitled to receive? What was his average monthly commission for the 3 months? What was his total income for the 3 months?

6. Coleman receives a salary of $60 a week as automobile salesman. Dwyer receives a salary of $30 a week and a commission of 2% on all automobiles sold. At the end of 32 weeks Dwyer's sales amount to $67,625. Which salesman has received the larger compensation and how much?

7. Solve a problem of your own which is based on the topic of this lesson.

UNIT 7

Commission on Sales—Graduated Basis

Example 1. Find the total earnings of each of the following salesgirls if a bonus of 1% is paid on sales reaching the given quota and an additional 2½% is paid on all sales above the quota.

Salesgirl	*Weekly Sales*	*Quota*	*Bonus*	*Salary*	*Total Earnings*
Charlotte Brown....	$350	$250	$5	$36	$41
Mary Evans........	250	300		40	
Maud Rogers.......	200	175		28	
Ray Winters........	50	100		28	
Margaret Thayer....	175	200		32	

What is meant by the term *quota?* Many retail stores set a weekly or monthly sales amount, or quota, for each salesperson, paying her a small commission on sales reaching the quota and a larger commission on all sales above the quota. This seems to be a very effective incentive for increasing sales and at the same time making it possible for salespeople to earn more by selling more. If a quota is not reached, no commission is earned.

Solution.

$250 × .01 = $2.50, commission on sales up to quota.
$100 × .025 = $2.50, commission on sales above quota.
$36 + $2.50 + $2.50 = $41, Charlotte Brown's total earnings.

Now compute the total earnings of each of the other four salesgirls.

Example 2. Mr. Morgan, who works for the Standard Refrigerator Company, renews his employment contract with the company under a new compensation arrangement. He is to receive $6 for each refrigerator that he sells each month up to 20 refrigerators, $6.50 for each from 20 to 40 refrigerators, and $7 for each over 40 refrigerators. If he sells 85 machines the first month, how much commission does he earn?

Solution.

20 × $6 = $120
20 × $6.50 = $130
45 × $7 = $315
$120 + $130 + $315 = $565, total commission.

Interior of a Large Department Store. Many of the salespersons work on a commission basis.

PROOF.

$$85 \times \$6 = \$510$$
$$20 \times \$.50 = \$10$$
$$45 \times \$1 = \$45$$
$$\$510 + \$10 + \$45 = \$565\text{, total commission.}$$

Problems

GROUP 1

Commission is paid upon total sales. Total salary is the commission, plus the monthly salary. Find the total monthly earnings of each of the seven salespeople in the Village Department Store:

	Clerk	*Monthly Sales*	*Monthly Salary*	*Rate of Commission*
1.	Richard Pool	$ 525	$150	
2.	Donald Burns	$ 650	$220	1%
3.	Paul Jones	$ 380	$160	3%
4.	Gladys Oswald	$ 350	$120	5%
5.	William McDonald	$ 750	$240	1½%
6.	Estelle Smith	$ 800	$200	½%
7.	Stanley Wilson	$1200	$150	7%

Group 2

A bonus of 2% is paid on sales equaling the given quota and an additional 3½% on all sales above the quota by the Richard Department Store. Find the total earnings of each of the following salesgirls:

	Salesgirl	*Weekly Sales*	*Quota*	*Salary*
1.	Jeanette Chivers	$450	$300	$40
2.	Shirley Ross	$350	$250	$45
3.	Joan Marshall	$550	$350	$50
4.	Mary Wright	$700	$475	$55
5.	Edith Maxwell	$625	$420	$52

6. The weekly sales for the Marvel Clothes Shop's salesmen were as follows:

Salesman	*Weekly Sales*
Alfred Dexter	$357
Henry Land	595
Robert Walters	895
Frank Sullivan	275
George Ralston	800

(*a*) What are the total sales of all the salesmen? (*b*) What per cent of total sales are the sales of each salesman? (*c*) Find each salesman's weekly earnings if he receives 6% commission on all sales. (*d*) Would it have been better for Mr. Ralston to work on a straight salary of $45 a week if this week's sales represent his average weekly business for the year on a commission of 6%? Why?

7. Mr. Gulliver, a salesman for the Wright Sewing Machine Co., receives $15 for each machine he sells up to 10 each month, $15.50 for each from 10 to 15, and $20 for each over 15. In May he sold 18 sewing machines, and in June he sold 24. How much did he earn in May? How much did he earn in June?

8. The Genesee Woolens Company pays S. W. Wall, a salesman, a salary of $250 a month. In addition, Wall receives 2% commission on his sales up to and including $2000 a month and 3% commission on any amount in excess of $2000. In April, Wall's sales amounted to $1580, and in May they amounted to $2830. What is the total amount of Wall's earnings for the 2 months?

9. Green, a salesman, receives a monthly salary of $80 and a 5% commission on all sales. In addition, he receives a commission of 1½% on sales in excess of $2500 in any single month. His sales amounted to $3340 in November and $2250 in December. Find his total commission and his average monthly income for the 2 months.

10. The following schedule of commissions was adopted by the City Real Estate Board on private sales of real estate:

Up to and including $100,000	2½%
From $100,000 to $1,000,000	1½%
From $1,000,000 to $2,000,000	1¼%
Above $2,000,000	1%

During the month of May, a real estate agency sold five lots for $750 each, seven lots for $740 each, one two-family house for $15,500, one four-family house for $22,000, and one apartment house for $165,750. What were the agency's total earnings for the month?

11. Solve one problem in this group by as many different methods as you can think of.

Chapter Test—Review

1. During the first quarter of the year, Mr. Cook earned $945.50. What did he contribute to the federal Old-Age Fund? What did his company contribute?

2. In a 13-week period, the F & H Super Market sent to the government $156 for old-age pension tax. What was its weekly payroll?

3. James Webb retired when his average monthly income was $280 What old-age insurance did he receive?

4. Larry Herbert's retirement pay is $62. He has a wife and one child under 18. What are the total benefits for the family?

5. Mr. Ray had average earnings of $240 when he died. He was eligible for old-age pension. How much did his widow receive monthly from the government?

6. The National Manufacturing Company made the following quarterly reports on wages:

First quarter	$12,684.50
Second quarter	10,732.00
Third quarter	11,556.25
Fourth quarter	12,947.25

Compute the federal and state unemployment taxes for the entire year.

7. The Acme Furniture Company sent $145.32 to the Federal Government for its share of the unemployment tax for one year. How much was the yearly payroll of the company?

8. Mr. Durant in one week worked 46 hours at a base pay of $1.70 per hour. His deductions were as follows: O. A. B., $1.87; Withholding tax, $8.60; Group insurance, $3.00; Misc., $2.00. Find his net pay for the week.

9. James Thomas, on piecework in an electrical appliance factory, completed the following number of parts in one week: M., 110; T., 108; W., 116; T., 124; F., 118. The rate was 15¢. Deductions: O. A. B., $1.94;

Withholding tax, $11.40; Union dues, $2.50; Hospitalization, $2.00. Find his net wage for the week.

10. Paul Monroe, a salesman for bakery supplies, received 12% on all sales up to $2000 and 8% on all sales above that amount. What did he receive in pay for monthly sales of $2750?

11. John Bauer, a salesman, receives a base pay of $150 a month. He receives an additional 6% on all sales. What is his monthly salary if he makes sales amounting to $4200?

12. Alice Reed receives a base salary of $35 a week as clerk in a department store. She is paid a bonus of 2% on all sales over $200. In one week she sells merchandise worth $450. What are her total earnings for the week?

Speed Drills in Fundamentals

Test 12

1–3. *Complete the following summary of articles:*

Day	*Dept.* A	*Dept.* B	*Total*
Monday	79	129	___
Tuesday	148	79	___
Wednesday	137	115	___
Thursday	163	129	___
Friday	87	98	___
Saturday	56	69	___
Totals			

Add:

4. $\frac{1}{2}$	**5.** $2\frac{1}{5}$	**6.** $5\frac{1}{16}$	**7.** $\frac{7}{12}$
$\frac{1}{4}$	$1\frac{1}{10}$	$2\frac{1}{8}$	$\frac{5}{24}$
$\frac{5}{8}$	$2\frac{3}{15}$	$3\frac{3}{20}$	$\frac{3}{4}$
$\frac{3}{4}$	$6\frac{2}{3}$	$6\frac{7}{8}$	$\frac{5}{6}$

Subtract:

8. 7943.17	**9.** 487	**10.** 219.45
896.48	45.8967	68.79
11. 903.7	**12.** 65.206	**13.** 52.006
85.312	12.198	24.0532

Multiply:

14. $12\frac{3}{4} \times 10 \times 15\frac{1}{2}$

15. $3 \times \frac{4}{12} \times 16 \times \$.045$

16. $15.75 \times 1.5 \times 2.75$

17. 1750 × $12.50 per M.

18. $40 \times 1 \times \frac{8}{12} \times 14 \times \frac{1}{1000} \times \$11.25$

Divide:

19. 3896 ÷ 120
20. .875 ÷ 480
21. 84.95 ÷ 212
22. \$4.80 ÷ 75%
23. \$11.25 ÷ .375
24. \$81.75 ÷ $33\frac{1}{3}$%
25. \$2000 ÷ $5\frac{1}{2}$
26. \$85.25 ÷ \$8.20
27. \$150 ÷ 7.5

Express as per cents:

28. .035
29. $.08\frac{1}{4}$
30. $1\frac{1}{2}$
31. $2\frac{3}{4}$

Change to fractions in lowest terms:

32. $2\frac{1}{2}$%
33. $18\frac{3}{4}$%
34. $15\frac{5}{8}$%
35. $3\frac{9}{16}$%

Change to mixed numbers:

36. $\frac{8}{5}$
37. $\frac{20}{12}$
38. $\frac{9}{2}$
39. $\frac{16}{6}$
40. $\frac{24}{7}$

Change to the units indicated:

41. 6 yd. to ____ in.
42. 6 gal. to ____ qt.
43. $2\frac{1}{2}$ tons to ____ lb.
44. 12 lbs. to ____ oz.

Find the annual premium on each life insurance policy:

45. \$10,000 policy @ \$54.50.
46. \$5000 policy @ \$32.20.
47. \$12,000 policy @ \$24.70.
48. \$5000 policy @ \$48.75.
49. \$10,000 policy @ \$14.00.
50. \$15,000 policy @ \$42.50.

Chapter 17

Bank Discount

RLaxmaReddy 1984 23th July

UNIT 1

Bank Discount

WHEN a person borrows a relatively small amount of money from a bank for a relatively short period of time, he signs an agreement to pay a specified sum of money at a specified future date. The written agreement is called a *note*. The amount to be repaid is the *face* of the note. The date on which the money is to be repaid is the *date of maturity*.

The borrower does not actually receive the amount stated on the note. The face of the note is the amount he must repay. The amount the borrower receives is the *proceeds* of the note. The time between the date of the note and the date of maturity is the *term of the note*.

In order to calculate the amount to give the borrower, the bank uses a process called *bank discount*. The amount which the bank deducts from the face of the note is also called the *bank discount*. That is, both the method of calculation and the amount deducted are known as "bank discount." The rate used in this calculation is a *bank discount rate*. The time from the date on which the note is discounted to the date of maturity is the *term of discount*.

The process will be illustrated by an example. This procedure is used by individuals and concerns as well as by banks.

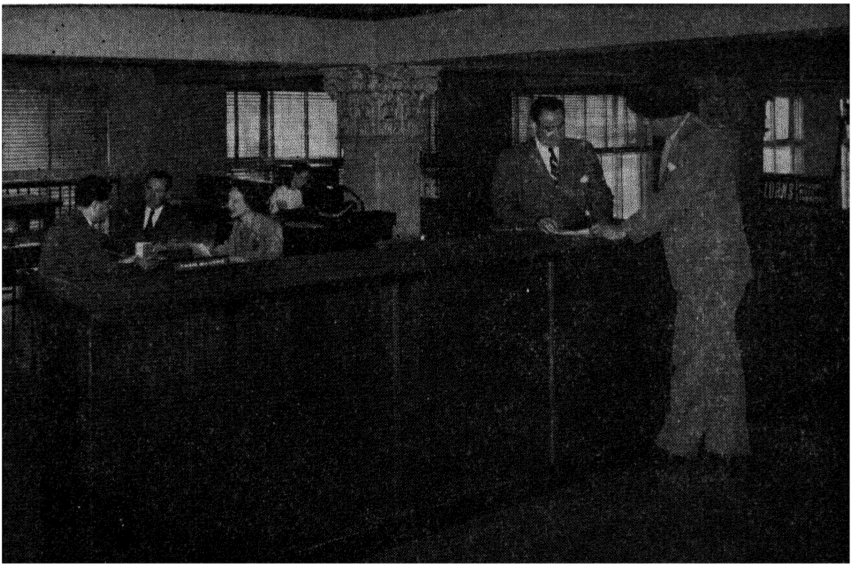
EXAMPLE 1. George Brown signs a note for \$500 due in 6 months. If the bank's discount rate is 6%, how much does he receive?

SOLUTION.

$$0.06 \times \frac{6}{12} \times \$500 = \$15, \text{ bank discount}$$

$$\$500 - \$15 = \$485, \text{ proceeds.}$$

In this example, the face of the note is \$500, the term of discount



Security-First National Bank of Los Angeles

Loan Department, Branch Bank.

is 6 months, the date of maturity is 6 months from the date of the note, the discount rate is 6%, the bank discount is \$15, and the proceeds is \$485.

EXAMPLE 2. Mr. Robert Whittaker signs a note at a bank in which he promises to pay \$1000 at the end of 1 year. The bank gives him \$945. What is the bank's discount rate?

SOLUTION.

$$\$1000 - \$945 = \$55, \text{ bank discount.}$$

$$\frac{55}{1000} = .055 = 5\tfrac{1}{2}\%, \text{ discount rate.}$$

Problems

GROUP 1

In each case find the bank discount and the proceeds:

	Face	*Term of Discount*	*Discount Rate*
1.	\$1000	1 year	5%
2.	\$ 400	6 months	5%
3.	\$ 800	1 year	6%
4.	\$ 500	18 months	6%
5.	\$2000	9 months	5½%

	Face	*Term of Discount*	*Discount Rate*
6.	$ 300	4 months	5%
7.	$ 200	3 months	7%
8.	$2400	10 months	6%
9.	$ 750	8 months	6½%
10.	$3000	7 months	6%

GROUP 2

1. Jim Atkins signs a note for $500 due in 6 months at the National Bank. The discount rate at the National Bank is 6%. How much does Jim Atkins receive from the bank?

2. Mrs. R. M. McClean signs a note for $1000 due in 9 months at the Security Bank. The bank at this time uses a discount rate of 5%. How much does the bank deduct from the face of the note?

3. Mr. Arthur C. Yates receives $930 cash at the Security Bank as the proceeds of a $1000 one-year note. What discount rate does the bank use?

4. Mr. J. Ben White signs a four-month note at the National Bank in which he agrees to pay $2000 at the end of 4 months. If the bank's discount rate is 5%, how much cash does he actually receive?

5. Miss Margaret Ainslee signs a note for $400 due in 6 months. She actually receives $390 cash from the bank. What is the bank's discount rate?

UNIT 2

Date of Maturity and Term of Discount

IF A NOTE is discounted on the same day that it is made, as in Unit 1, there is no question as to the term of discount. Sometimes, however, a note signed on a certain date and due in, say, one year, will be transferred to a third party who will discount the note at some date between the date on which it is made and the date on which it is due. In such a case, the term of discount and the term of the note will not be the same.

If the time is expressed in days, the date of maturity must be the *exact* number of days after the date of the note.

EXAMPLE 1. Find the date of maturity of a 60-day note dated Mar. 15.

$$\text{60 days (term of note)}\left\{\begin{array}{l}\text{Mar. 15 (date of note)}\\ \\ \text{May 14 (date of maturity)}\end{array}\right.$$

First Solution.

Mar. 15 to Mar. 31	16 da.
Plus days in April	30 da.
	46 da.

60 − 46 = 14, days in May.
Date of maturity is May 14.

Second Solution.

Mar.	15
Plus term of note	60 da.
	75 da.
Less days in March	31 da.
	44 da.
Less days in April	30 da.
	14, days in May.

Date of maturity is May 14.

Example 2. Find the date of maturity of a 2-mo. note dated Mar. 15.

If the time is expressed in months, the date of maturity is simply the same day of the month the given number of months ahead.

$$\text{2 mo. (term of note)}\left\{\begin{array}{l}\underline{\text{Mar. 15 (date of note)}}\\ \\ \underline{\text{May 15 (date of maturity)}}\end{array}\right.$$

Solution. 2 mo. after Mar. 15 is May 15.

Thus, although the notes in these two problems are both dated the same day, the date of maturity is different, because in one case the term is 60 days and in the other it is 2 months.

When a note for which the time is expressed in months is dated on the last day of a month and falls due in a month having fewer days, the date of maturity is considered as being the last day of that month. For example:

One month from Mar. 31 is Apr. 30.

Two months from July 31 is Sept. 30.

One month from Jan. 29, 30, or 31 is Feb. 28, or, in leap year, Feb. 29.

When the time is expressed in days, this condition is not present.

We have learned that the term of discount is the number of days between the date when the note is discounted and the date of maturity, and, just above, we saw how the date of maturity is found. Since the bank bases its interest or discount on this term of discount, it is essential that it be accurate.

Example 3. On Apr. 25 A. Rudd discounts a customer's 3-month note for $500 dated Mar. 1. What is the term of discount?

Solution. Mar. 1 (date of note)

3 mo. (term of note) { Apr. 25 (date of discount)

June 1 (date of maturity) } 37 da. (term of discount)

When the time of the note is in days, you may subtract the time between the date of the note and the date of discount from the time of the note to find the term of discount. This method is simpler when the time between the date of the note and the date of discount is short.

Problems

Group 1

Find the date of maturity of:

1. A 60-day note dated May 15.
2. A 30-day note dated April 2.
3. A 60-day note dated June 8.
4. A 90-day note dated May 14.
5. A 30-day note dated October 20.
6. A 90-day note dated November 30.
7. A 45-day note dated September 1.
8. A 180-day note dated March 11.
9. A 20-day note dated April 17.
10. A 70-day note dated August 10.

Find the date of maturity of a 2-month note dated:

11. February 14.
12. March 20.
13. April 26.
14. May 28.
15. March 31.
16. August 31.
17. December 31.
18. November 30.
19. May 31.
20. October 30.

Group 2

Find the term of discount:

	Date of Note	*Time to Maturity*	*Date of Discount*
1.	April 20	3 months	May 2
2.	March 15	2 months	April 12
3.	May 30	1 month	June 10
4.	June 18	4 months	August 23
5.	November 20	6 months	April 14

	Date of Note	*Time to Maturity*	*Date of Discount*
6.	December 16	60 days	January 20
7.	March 18	30 days	April 3
8.	April 2	60 days	May 18
9.	May 8	90 days	July 5
10.	June 3	45 days	July 18

UNIT 3

Net Proceeds of a Non-Interest-Bearing Note

After the term of discount is found, the interest for that number of days is found and deducted from the face of the note. The difference is the *net proceeds.*

Example. A $1000 90-day note dated Jan. 16 is discounted at 6% on Mar. 15. Find the bank discount and the net proceeds.

Jan. 16 (date of note)
90 da. (term of note)
Mar. 15 (date of discount)
(1) Apr. 16 (date of maturity)
(2) 32 da. (term of discount)

	Face of note	$1000.00
(3)	Bank discount	$ 5.33
(4)	Net proceeds	$ 994.67

(The numbers in parentheses indicate the sequence of the steps in the solution.)

Solution.

Step 1. Find the date of maturity.

Jan. 16 to Jan. 31	15 da.
Add days in February	28 da.
Add days in March	31 da.
	74 da.

90 − 74 = 16

Date of maturity is Apr. 16.

Step 2. Find the term of discount.

Mar. 15 to Mar. 31	16 da.
Add days in April	16 da.
	32 da., term of discount.

Step 3. Find the amount of discount.

Interest for 60 da. at 6% $10

Interest for 20 da. at 6% $3.33

Add interest for 12 da. at 6% $2.00

$5.33, interest, or bank discount.

Step 4. Find the net proceeds.

$1000 − $5.33 = $994.67, net proceeds.

Problems

Find the net proceeds of each of the following notes, which are discounted the day they are drawn:

	Face of Note	*Time of Note*	*Discount Rate*
1.	$700	60 da.	6%
2.	$200	2 mo.	5%
3.	$60	4 mo.	6%
4.	$1500	90 da.	4½%
5.	$10,400	30 da.	4%

6. You received from Charles Smith on Sept. 4 his 60-day promissory note for $620. What will you receive for it if it is discounted in the bank on Sept. 25 at 6%?

7. George Hinds discounts Joseph Lane's 60-day promissory note for $880 on May 12 at 6%. The date of the note is Apr. 30. How much credit will George Hinds receive from the bank?

8. Henry Green received a 90-day promissory note for $2000 dated June 8. He discounted the note at the bank on June 22 at 4½%. Find the proceeds.

9. A note for $1250, dated June 5, payable 6 mo. after date, was discounted at a bank 1 mo. after June 5 at 6%. Find the proceeds.

10. Find the proceeds of a note for $1800 payable 4 mo. after Mar. 16 and discounted at a bank on Apr. 11 at 5%.

11. What is the bank discount on a trade acceptance for $480, accepted Apr. 10, and payable in 4 mo., if it is discounted at a bank on June 1 at 6%?

12. Solve a problem of your own which is based on the topic of this lesson.

UNIT 4

Discounting Interest-Bearing Notes

In discounting interest-bearing or non-interest-bearing notes, the bank is interested in how much it will receive at maturity. In non-interest-bearing notes, the *maturity value* is the same as the face value, but in interest-bearing notes it is the sum of the face value and the interest for the time of the note. Since the bank bases its computation of discount on the maturity value, this value must be computed for interest-bearing notes.

Finding the Net Proceeds of an Interest-Bearing Note

EXAMPLE. James Burke received the following note from Thomas Hughes, a customer:

\$1800 $\frac{00}{100}$ Boston, Mass., *Mar. 31, 19—*

Ninety days after date I promise to pay to the order of *James Burke* - - - - - - - - -

One Thousand Eight Hundred $\frac{xx}{100}$ - Dollars

Value received, with interest at *6%*

No. *8* Due *June 29, 19—* *Thomas Hughes*

If James Burke discounts this note at his bank on Apr. 20, what will be the net proceeds?

Mar. 31 (date of note)
90 da. (time of note)
Apr. 20 (date of discount)
(3) 70 da. (term of discount)
(2) June 29 (date of maturity)

	Face of note	\$1800.00
	Interest	\$ 27.00
(1)	Maturity value	\$1827.00
(4)	Bank discount	\$ 21.32
(5)	Net proceeds	\$1805.68

(The numbers in parentheses indicate the sequence of the steps in the solution.)

SOLUTION.

Step 1. Find the maturity value.

Interest for 60 da. at 6%	\$18
Add interest for 30 da. at 6%	\$ 9
	\$27, interest for 90 da. at 6%.

\$1800 + \$27 = \$1827, maturity value.

Step 2. Find the date of maturity.

Mar. 31 to Apr. 30	30 da.
Add days in May	31 da.
	61 da.

90 − 61 = 29
Date of maturity is June 29.

Step 3. Find the term of discount.

Apr. 20 to Apr. 30	10 da.
Add days in May	31 da.
Add days in June	29 da.
	70 da., term of discount.

Step 4. Find the bank discount.

Maturity value		$1827
Interest for 60 da. at 6%	$18.27	
Add interest for 10 da. at 6%	$ 3.045	
	$21.315, or $21.32, interest, or bank discount, for 70 da. at 6%.	

Step 5. Find the net proceeds.

Maturity value	$1827.00
Less bank discount	$ 21.32
	$1805.68, net proceeds.

Rates other than 6% for both interest and discount are often found in bank discount problems.

Problems

Find the net proceeds on each of the following interest-bearing notes:

	Date of Note	*Face of Note*	*Time of Note*	*Rate of Interest*	*Date of Discount*	*Rate of Discount*
1.	Jan. 10	$ 480	60 da.	6%	Feb. 3	6%
2.	Apr. 7	$1500	90 da.	6%	May 7	6%
3.	Mar. 5	$ 160	30 da.	6%	Mar. 15	6%
4.	Oct. 8	$ 840	2 mo.	5%	Nov. 7	4½%
5.	Dec. 4	$1800	3 mo.	4%	Jan. 5	3%
6.	July 6	$1440	1 mo.	5½%	July 12	5%

7. Find the proceeds of the following note, which was discounted on Aug. 5 at 6%.

$840 $\frac{00}{100}$ Chicago, Ill., *July 2, 19—*

Ninety Days after date I promise to pay to the order of *J. Blane* - - - - - - - - - - -

Eight Hundred Forty $\frac{00}{100}$ - Dollars

Value received, with interest at *6%*.

No. _____ Due _____ *Matthew Johnson*

Chapter Test—Review

1. Mary Alden signs a note for $300 due in 8 months. If the bank's discount rate is 5%, how much cash does she receive?

2. The face of a note is $2500, the term of discount is 10 months, and the discount rate is 6%. Find the bank discount and the proceeds.

3. Find the date of maturity of a 90-day note dated April 2.

4. On May 3 Mr. Arthur Gates discounts a customer's 4-month note dated April 7. What is the term of discount?

5. Find the date of maturity of a 6-month note dated March 12.

6. A $2000 60-day note dated June 23 is discounted on July 17, at 5%. Find the bank discount and the net proceeds.

7. An interest-bearing note is dated July 5. The face is $500, the term of the note is 60 days, and the rate of interest is 5%. The note is discounted on Aug. 2 at 4%. Find the net proceeds.

8. A note for $900, dated April 12, 1952, with interest at 6%, had the following payments endorsed upon it: Oct. 12, 1952, $400; April 12, 1953, $300. How much was payable on June 12, 1953?

Speed Drills in Fundamentals

Test 13

Add:

1. $367.85
809.27
112.67
110.24
63.90
310.87
364.57
179.56
894.75
868.88
____

2. $7 + 8 + 3 + 5 + 7 =$
$9 + 5 + 6 + 9 + 8 =$
$8 + 4 + 9 + 7 + 6 =$
$5 + 7 + 4 + 9 + 3 =$
$4 + 9 + 5 + 6 + 3 =$
$3 + 2 + 8 + 4 + 6 =$
$9 + 3 + 5 + 3 + 8 =$

Totals _____

3.	**4.**	**5.**	**6.**	**7.**
$6\frac{1}{16}$	$\frac{1}{3}$	$4\frac{11}{16}$	$4\frac{7}{12}$	$10\frac{9}{64}$
$5\frac{5}{8}$	$\frac{1}{4}$	$3\frac{3}{8}$	$2\frac{3}{4}$	$5\frac{5}{8}$
$4\frac{3}{4}$	$\frac{2}{3}$	$5\frac{1}{2}$	$5\frac{3}{8}$	$12\frac{3}{32}$
$5\frac{1}{6}$	$\frac{7}{8}$	$6\frac{2}{3}$	$4\frac{3}{4}$	$4\frac{7}{16}$

Subtract:

8.	**9.**	**10.**	**11.**
$51\frac{3}{4}$	42	65	187
$28\frac{1}{2}$	$9\frac{7}{9}$	$31\frac{4}{7}$	$128\frac{5}{12}$

12.	**13.**	**14.**	**15.**
$100	$2400.00	$320.00	$165.50
82.5	785.65	106.68	28.65

Find the total commission earned on each of these sales:

16. 270 bu. @ $3\frac{1}{3}$¢
226 bu. @ $2\frac{1}{2}$¢
750 bu. @ 4¢
380 bu. @ 5¢
1160 bu. @ 2¢

17. $760 @ 6%
1242 @ 2%
783 @ 3%
560 @ $2\frac{1}{2}$%
382 @ 4%

Multiply:

18.	**19.**	**20.**
7 mo. 22 da.	16 ft. 8 in.	2 bu. 1 pk.
4	6	12

Divide:

21. $12\frac{1}{2} \div 2\frac{4}{5}$
22. $40 \div \frac{5}{8}$
23. $100 \div .37\frac{1}{2}$
24. $87\frac{1}{2} \div 3\frac{3}{8}$
25. $4\frac{5}{6} \div 2\frac{3}{8}$
26. $\frac{1}{2} \div \frac{1}{4}$
27. 12 yd. 2 ft. ÷ 6
28. 8 lb. 6 oz. ÷ 5

Change to decimals:

29. $\frac{1}{2}$%
30. $115\frac{1}{2}$%
31. .3%
32. $2\frac{3}{4}$%

Arrange from largest to smallest:

33. .654—.655—7.3
34. 1.02—1.002—1.22
35. .025—.035—.04
36. 12.32—12.333—12.034

Solve:

37. $9\frac{1}{11}$% of 180 is ____.
38. .5% of 12,000 is ____.
39. $187\frac{1}{2}$% of 320 is ____.
40. $14\frac{2}{7}$% of 77 is ____.
41. 12 is ____% of 12.
42. ____% of 64 is 16.
43. ____% of 15 is 1.
44. 6 is ____% of 50.

Complete the following payroll based on a 40-hour week:

45. 44 hours @ $1.20
46. 46 hours @ 2.10
47. 42 hours @ 1.80
48. 50 hours @ 1.75
49. 45 hours @ 1.95
50. 43 hours @ 1.60

Chapter 18

Trade Discounts

UNIT 1

Single and Successive Trade Discounts

MANUFACTURERS, wholesale dealers, and mail-order houses issue catalogs to describe the articles they offer for sale. The price of an article as listed in the catalog is called the *list price* of the article. A *trade discount* is a deduction from the list price. For example, the list price of a suit of clothes may be $50. Later, the price of the suit of clothes may be quoted as "list price less 20%." Thus, 20% of $50 is $10, and a deduction of $10 would make the suit sell for $40. Trade discounts are usually expressed as a per cent of the list price. Trade discounts are offered for many reasons, as, to reward large and steady customers, to keep pace with changes in prices after the catalog has been issued, and to attract new customers.

The cost of goods after the trade discount has been deducted is called the *net price* or *net cost.*

Many articles, such as radios, watches, and fountain pens, are listed in the wholesalers' catalogs at retail prices, and a sufficient discount is given the retailer to cover his margin (overhead expenses and profit).

Sometimes *successive discounts* are given. Thus, "$50 less 20% and 5%" means that 20% of $50 is deducted from $50, leaving $40, and then 5% of the remainder, $40, is deducted from $40; that is. $2 is deducted from $40, leaving $38. Two or more discounts, taken in succession, are called a *discount series* or *successive discounts.*

EXAMPLE 1. Find the net cost of a radio that is quoted at 30% less than list price, if the list price is $60.

Solution.

30% of \$60 = 0.30 × \$60 = \$18, trade discount.
\$60 − \$18 = \$42, net price.

Example 2. Find the net cost of the radio in Example 1 if it is quoted at list price less 20% and 10%.

First Solution.

20% of \$60 = 0.20 × \$60 = \$12, first discount.
\$60 − \$12 = \$48.
10% of \$48 = 0.10 × \$48 = \$4.80, second discount.
\$48 − \$4.80 = \$43.20, net price.

Second Solution.

10% of \$60 = 0.10 × \$60 = \$6.
\$60 − \$6 = \$54.
20% of \$54 = \$10.80.
\$54 − \$10.80 = \$43.20, net price.

Notice that successive trade discounts of 20% and 10% are *not* equivalent to a single discount of 30%. Also, notice that either discount may be deducted first, and the same result is eventually obtained for the net price.

Problems

Group 1

Find the net price of each of the following articles:

1. Plane, \$4 less 15%.
2. Saw, \$2.50 less 20%.
3. Pipe threader, \$20 less 10%.
4. Tool cabinet, \$57 less 10%.
5. Bench vise, \$8 less 12½%.
6. Pipe wrench, \$1.95 less 5%.
7. Electric drill, \$15 less 25%.
8. Drill press, \$85.90 less 20%.
9. Electric grinder, \$24.95 less 10%.
10. Paint sprayer, \$44.95 less 15%.

Find the trade discount and net price of each of the following, using aliquot parts whenever possible:

	List	*Rate of Discount*		*List*	*Rate of Discount*
11.	\$ 480	33⅓%	**19.**	\$ 100	5% and 5%
12.	\$ 500	20% and 10%	**20.**	\$ 200	10%, 10%, and 5%
13.	\$ 600	25% and 20%	**21.**	\$1000	50%, 25%, and 10%
14.	\$ 320	12½% and 12½%	**22.**	\$2000	25%, 25%, and 20%
15.	\$ 360	40% and 20%	**23.**	\$1200	10%, 5%, and 5%
16.	\$1400	10% and 5%	**24.**	\$ 800	12½%, 20%, and 10%
17.	\$2400	50% and 37½%	**25.**	\$ 900	33⅓%, 33⅓%, and 5%
18.	\$3600	50% and 25%			

GROUP 2

1. The Ace radio is listed at $200. The wholesaler allows the retailer trade discounts of 20% and 5%. Find the net price.

2. The Moderne Television Co. lists its 20-inch screen set at $500. It offers trade discounts of 20% and 10% to the Mason Appliance Co. Find the net price of the set.

3. The Hammond Company, a mail-order house, lists down-filled sleeping bags at $80 each in their 1951 catalog. In early 1952 they send a discount sheet to their customers, announcing a trade discount of $16\frac{2}{3}$%. Find the net price of the sleeping bags.

4. The Perfection Hardware Co. receives a shipment of gardening tools that were listed at $2500. They are allowed trade discounts of 20% and 5%. Find the net price of the shipment.

5. Which is better, an offer of trade discounts of 10% and 10%, or 15% and 5%?

6. Which is better, an offer of trade discounts of 20%, 15%, and 5%, or 25%, 2%, and 3%?

7. How much should a retail merchant pay for 4 dozen men's shirts listed at $3 each, if he is allowed trade discounts of 10% and 5%?

8. A jobber receives a shipment of electric ranges from a manufacturer. They are listed at $500 each. If the manufacturer allows the jobber trade discounts of 10%, 10%, and 5%, what is the net price to the jobber?

9. Which is the greater discount, a single discount of 25% or two successive discounts of 20% and 5%?

10. The United Drug Store receives a shipment of electric razors that are listed in the manufacturer's catalog at $20 each. If the drugstore is allowed trade discounts of 10% and 5%, what is the net price of the shaver to the drugstore?

11. Find the net price of an electric motor listed at $150, less trade discounts of 20% and 10%. Find the net price if a single discount of 30% were allowed.

UNIT 2

Finding a Single Discount Equal to a Series of Discounts

IT IS POSSIBLE to combine a series of discounts into a single equivalent discount.

EXAMPLE 1. Find a single discount equivalent to successive discounts of 20% and 10%.

First Solution.

List price	100%
Less 20%	20%
	80%
Less 10% of 80%	8%
	72%

Equivalent single discount, 100% − 72% = 28%.

Second Solution.

List price 100%
100% − 20% = 80%
100% − 10% = 90%
.90 × .80 = .72, net price.
100% − 72% = 28%, equivalent discount.

Example 2. Find a single discount equivalent to the series of discounts 25%, 10%, and 5%.

First Solution.

List price	100%
Less 25%	25%
	75%
Less 10% of 75%	7.5%
	67.5%
Less 5% of 67.5%	3.375%
Net price	64.125%

Equivalent single discount, 100% − 64.125% = 35.875%.

Second Solution.

100% − 25% = 75%
100% − 10% = 90%
100% − 5% = 95%
.75 × .90 × .95 = .64125
100% − 64.125% = 35.875%

Changing a series of discounts to an equivalent single discount is especially useful if a large number of calculations are to be made with the same series of discounts.

Problems

Group 1

The Triangle Sporting Goods Company has decided to quote single discounts on its articles. Below is a list of articles with their successive discounts. In each case, find a single discount which will take the place of the two discounts.

1.	Sweaters	40% and 10%	6. Tennis Rackets	20% and 10%
2.	Baseballs	40% and 20%	7. Pack Sacks	30% and 20%
3.	Tennis Shoes	40% and 30%	8. Camp Kits	30% and 30%
4.	Tennis Nets	50% and 20%	9. Fishing Rods	40% and 33⅓%
5.	Tennis Balls	50% and 30%	10. Basketballs	40% and 16⅔%

GROUP 2

Find single discounts equal to the following series:

1. 40% and 5%
2. 35% and 10%
3. 15% and 5%
4. 20%, 5%, and 2%
5. 40%, 20%, and 5%
6. 50%, 20%, and 2%

7. Which price is better for the purchaser, and how much: $135 less 25%, 16%, and 6%, or $120 less 32%, 27%, and 2%?

8. John Sullivan is offered a desk by the Majestic Furniture Company for $100 less 30% and 15%. The Superior Furniture Company offers the same desk for $120 less 20%, 15%, and 5%. Which is the better offer? How much does John Sullivan save by taking advantage of it?

9. The Canadian Cannery Company's discounts are 15% and 5%. Mr. Johnston, a salesman, sold merchandise for $168 and gave a discount of 20%. How much did Mr. Johnston's error cost the Canadian Cannery Company?

10. Robert Jordan sent a check to his wholesalers in payment of an invoice for $205.45. What was the list price of the invoice if the discounts were 5% and 1%?

11. The Rowe Manufacturing Company offered to sell a dining-room suite to a dealer for $250 less 20%, 10%, and 10%. The Wilson Furniture Company offered to sell a dining-room suite of similar quality for $260 less 40%. Which is the better offer? How much is saved by taking advantage of it?

UNIT 3

Special Problems in Trade Discount

ALTHOUGH it is the usual business custom for wholesale establishments to sell only at wholesale and for retail establishments to sell only at retail, there are some firms that do both. Such concerns display on showcards in their windows or on the windows themselves information that sales are made at both wholesale and retail.

We have learned by this time that sales at wholesale, because they involve larger quantities, are made at lower prices than sales at retail. Therefore, the commercial house that caters to both types of customers needs two prices for each article it offers for sale, and problems arise in establishing these prices.

Finding the List Price When the Net Price and Rates of Discount are Given

Example 1. A firm decides to offer its wholesale customers discounts of 25% and 20% off the retail price. One article is offered to wholesalers at a price of \$2.10. What should the list price (that is, the retail price) of the article be?

Solution.

Let 100% = list price.
25% and 20% = 40%, single discount.
100% − 40% = 60%, net price (wholesale price).
\$2.10 = 60%
\$2.10 ÷ 60 = \$0.035, 1% of list price.
\$0.035 × 100 = \$3.50, list price (retail price).

Proof.

List price	\$3.50
Less 20%	.70
	2.80
Less 25%	.70
	\$2.10, wholesale price.

Now try your skill at preparing a "price list" for a wholesale merchandise company.

Example 2. Find the list prices for the following articles:

Article	*Net Price*	*Rates of Discount*	*List Price*
Desk Lamp...........	\$2.88	20% and 10%	
Book Case............	5.95	30% and 15%	
End Table............	2.56	20% and 20%	
Book Ends............	1.80	33⅓%	

The list price for desk lamps is \$4. Prove it. Find the list prices of the other articles.

Finding the List Price and Net Price When the Rates and Amount of Discount Are Given

In Unit 1 we learned how to find the net price when the list price and the rates of discount are given, and in this lesson we have seen how the list price is found when the net price and rates of discount are known. A third type of problem that occasionally must be solved consists of finding the list price and net price when the rates and amounts of discount are given.

Example. The discounts on an invoice of goods are 30% and 10%, and these discounts, when computed on the list price, amount to $248.40. What is the list price and the net price?

Solution.

30% and 10% = 37% single discount
37% = $248.40
$248.40 ÷ 37% = $671.35, list price.
$671.35 − $248.40 = $422.95, net price.

First Proof.

List price	$671.35
Less 30% (first discount)	201.41
	$469.94
Less 10% (second discount)	46.99
	$422.95, net price.
List price	$671.35
Less net price	422.95
	$248.40, amount of discount.

Second Proof.

100% − 37% = 63% = .63
$671.35 × .63 = $422.95, net price.
$671.35 − $422.95 = $248.40, amount of discount.

Problems

Group 1

Find the discount and the net price in each of the following:

	List Price	*Rates of Discount*		*List Price*	*Rates of Discount*
1.	$375	33⅓%	**4.**	$1500	25% and 20%
2.	$480	25%	**5.**	$2500	50% and 10%
3.	$600	16⅔% and 10%	**6.**	$1200	12½% and 20%

Group 2

1. A merchant paid $2428.20 for an invoice of goods after 10% and 5% had been deducted. What was the amount of the invoice?

2. Find the amount of an invoice of goods the net amount of which was $1208.62 after discounts of 30% and 3% were deducted.

3. The discounts on an invoice of goods were 20% and 3%, and the amount of discount was $349.44. What was the list price of the goods?

4. Gas fixtures were bought at discounts of 35% and 10% and sold at discounts of 10% and 5%. How much was made on each dollar's worth handled?

5. Bathtubs were bought at $65 each less 40% and 4%, and were sold at the same list price less 8%. How much was made on the sale of 20 tubs?

6. Overcoats which had been marked to sell for $67.50 were marked down to $45. The difference in price is equal to what per cent discount on the original price?

7. A furniture dealer marked prices down as follows: Chairs marked $8, now $6.40; stands marked $12, now $9; and rockers marked $18, now $12.60. What was the rate of discount in each case?

8. By taking the 5% discount offered on a bill of goods, a merchant saved $43.21. Find the face of the bill before the discount was taken.

9. The Universal Sales Company has been selling refrigerators at $160 less 25%. To meet competition, the company decides to allow a second discount so that the refrigerators may be sold at $110.40. Express as a rate per cent the second discount that the company must offer.

10. Solve any problem in this group by as many different methods as you can think of.

UNIT 4

Cash Discount

UNITS 1, 2, and 3 of this chapter were concerned with trade discounts—that is, deductions allowed because of the quantities of merchandise purchased or because of market declines. This lesson is concerned with another type of discount, one which has nothing whatever to do with the reasons just mentioned. To illustrate, examine the invoice on the next page.

Immediately beneath the name and address of the seller the terms are mentioned: 3/10, n/60. These terms refer to the time of payment and are offered to induce the debtor (Frank Jones) to pay his bill more quickly. Specifically, these terms mean that 3% discount is offered to the customer if the bill is paid in 10 days or less. However, if payment is not made within 10 days, the buyer has 60 days within which to remit, but, in that case, he must pay the full amount of the bill. Obviously, therefore, it is to his advantage to pay within the 10 days to earn this discount. What advantage is there to the seller in offering this cash discount?

INVOICE

Buffalo, N. Y., August 3, 19—.

Frank Jones
Jones House Furnishings Store
St. Louis, Missouri

Bought of:

THE HOWARD HARDWARE COMPANY
BUFFALO, NEW YORK

Terms: 3/10, n/60

3¼ doz.	Strap Hinges No. S.H. 92.......@ $8.28	$ 26.91
18 "	Carriage Bolts No. C.B. 1337....@ 5.65	101.70
9 "	pkg. ¼ Rivets No. W.B. 30......@ 1.45	13.05
15 "	pkg. Steel Rivets No. F.S. 17....@ 1.56	23.40
		$165.06
	Less 8% and 5%	20.79
		$144.27
	Less 3%	4.33
		$139.94

EXAMPLE. Just how is this discount of 3% computed?

A glance at the invoice shows us that the list price amounts to $165.06, from which trade discounts of 8% and 5%, amounting to $20.79, are deducted. The customer, therefore, is legally obligated to pay a sum of $144.27. The creditor, however, to induce quicker payment, has offered a discount of 3% if the bill is paid within ten days. This 3%, therefore, is computed on the amount due, $144.27, and not on the list price. Since 3% of $144.27 equals $4.33, the buyer deducts this amount from the net price, $144.27, and remits $139.94 to the creditor. Since this discount of $4.33 is a result of paying a bill before the full credit terms have expired, it is called a *cash discount*, or one that is given because of a payment of cash. This, you see, is different from a trade discount, which in no way depends upon the date of payment of a bill.

Discount Dates and Due Dates

EXAMPLE 1. The terms on the bill illustrated on this page are 3/10, n/60. The date of the invoice is Aug. 3. What, then, is the last day this bill can be paid and the 3% still be deducted?

Solution.

Date of invoice	Aug.	3
Plus 10 da.		10
	Aug.	13, last day on which payment may be made and discount taken.

Example 2. If payment is not made by Aug. 13, when must it be made in full, without benefit of a cash discount?

Solution.

Date of invoice	Aug.	3
Plus 60 da.		60
		63
Less days in August		31
		32
Less days in September		30
	Oct.	2, due date.

Occasionally terms such as the following are given: 2/10, 1/30, n/60. Translated, they mean that a discount of 2% will be given if payment is made within 10 days; if payment is not made within 10 days but is made within 30 days, a discount of 1% will be allowed; and, if payment is not made within 30 days, payment in full will be due in 60 days. Terms may also be stated as 4/10 E.O.M., which means that a discount of 4% will be allowed if the bill is paid within 10 days from the end of the month in which the bill is dated. Another cash term is 2/10, 90X, which means that a discount of 2% will be allowed if the bill is paid within 10 days. The *X* stands for "Extra," and means that 90 days extra or 90 days *dating* will be allowed.

Problems

Group 1

Give the meaning of the following terms found on invoices:

1. 2/10, n/30 **2.** 5/10, 2/30, n/60 **3.** 3/10, 60X

Determine the last date on which discount should be taken in each of the following:

	Date of Bill	*Terms*
4.	July 19	2/10, n/30
5.	Aug. 5	5/10, 2/30, n/60
6.	Sept. 8	2/30, n/3 mo.

7–9. Find the due dates in Problems 4–6 if discounts are not taken.

Find the amount due on the following invoices:

	Date of Invoice	*Amount of Invoice*	*Terms*	*Date of Payment*
10.	Feb. 10	$350	3/30, n/60	Mar. 12
11.	Apr. 5	$525	2/10, 1/30, n/60	May 5
12.	Apr. 25	$455	2/10, n/30	May 7

Group 2

Find the net amount of each of the following if the cash discount is taken:

	Amount of Bill	*Terms*		*Amount of Bill*	*Terms*
1.	$1275	4/10, n/90	**5.**	$1160.70	6/10, n/4 mo.
2.	$1780.60	3/5, n/30	**6.**	$1677.20	4/10, n/60
3.	$1560.80	2/10, n/30	**7.**	$375.25	4/10, n/4 mo.
4.	$886.70	5/10, n/4 mo.	**8.**	$2435.15	3/10, n/90

9. Sold to M. A. Hoffman, Omaha, Nebraska, terms 3/10, n/60, F. O. B. mine:

184,800 lb. Egg Coal	@	$4.90 per long ton
150,080 lb. Stove Coal	@	5.20 per long ton
96,880 lb. Chestnut Coal	@	5.10 per long ton

Find the net amount if the bill is paid in 10 days.

10. Sold to A. S. Crane, Duluth, Minnesota, terms 2/30, n/60:

$3\frac{2}{3}$ doz. Padlocks G. C. No. 27	@	$3.70
$2\frac{1}{3}$ doz. Padlocks G. S. No. 34	@	2.28
$2\frac{1}{4}$ doz. Pulleys F. P. No. 290	@	5.75
12 kegs Nails No. 8	@	4.95

Find the net amount if the bill is paid in 60 days.

Chapter Test—Review

Group 1

Find the net price:

1. $80 less 20%.

2. $100 less 10% and 20%.

3. $15 less 25% and 20%.

4. $200 less 15%, 10%, and 5%.

Find the single equivalent discount:

5. 20% and 10%.

6. 10% and 5%.

7. 50% and 25%.

8. 40% and 10%.

Find the list price:

9. Net price, $200; discounts, 10% and 10%.

10. Net price, $50; discounts, 15% and 5%.

11. Net price, $80; discounts, 20% and 10%.

12. Net price, $20; discounts, 10%, 10% ,and 5%.

Find the amount due:

13. Invoice, $300; date of invoice, Feb. 4; terms, 2/30, n/60; date of payment, March 2.

14. Invoice, $500; date of invoice, Apr. 2; terms, 2/10, 1/30, n/60; date of payment, Apr. 14.

Group 2

1. Which is better for the customer; discounts of 20% and 10% or discounts of 10% and 20%?

2. Find the net cost of a television set that is listed at $400, if discounts of 10% and 5% are offered.

3. Mr. Johnson has the choice of buying hardware from two companies that offer discounts of (*a*) 20% and 10% and (*b*) 30%. How much will he save on $1000 by choosing the 30% offer?

4. A catalog of automobile parts and accessories is accompanied by a dealer's folder in which discounts of 25% and 5% are quoted to certain dealers. By what per cent can the dealer multiply the catalog price in order to obtain his net price?

5. The Washington Sales Corp. has been selling electric washing machines at $400 less 15%. They decide to offer a second discount that will yield a price of $306. What second discount must they offer?

6. Mr. Barney Zimmerman receives an invoice noted "2/30, n/60." If the invoice is dated Jan. 7 and he pays it on Feb. 5, does he receive a cash discount?

7. Sold to the Perfection Hardware Co., terms 2/30, n/60:

2 doz. brass valves @ $1.10
10 coils rope oakum @ $2.29
100 ft. galvanized steel pipe @ 12¢
10 gal. spar varnish @ $5.28

Find the net amount if the bill is paid in 24 days.

8. Discounts of 20% and 10% were deducted from the list price of a machine. If $248 was deducted, find the list price. How much was paid for the machine?

Speed Drills in Fundamentals

Test 14

Add:

1. $175.89
62.74
289.53
675.32
554.65
28.28
367.46
173.31
459.38
62.75
179.84
256.43

2. $ 37.50
61.43
27.45
3.05
59.65
45.72
1.07
124.84

3. 24%
$11\frac{1}{4}\%$
$13\frac{1}{2}\%$
$17\frac{3}{8}\%$
$12\frac{3}{8}\%$
$6\frac{3}{4}\%$

4. $48\frac{1}{8}$
$72\frac{3}{8}$
$64\frac{1}{4}$
$89\frac{1}{2}$
$94\frac{1}{8}$

5. $46\frac{1}{8}$
$72\frac{1}{4}$
$84\frac{1}{2}$
92
$87\frac{3}{8}$

6. .083 + .875 + .006 + 2.9
7. 5.03 + 4.99 + 2.375 + 4.102
8. 3.8 + 2.25 + .625 + 1.5
9. 11.2 + .0075 + 1.2 + 86.045
10. 1.5 + 6.909 + 52.6 + .0375

Subtract:

11. $65\frac{11}{16}$
$14\frac{2}{3}$

12. $87\frac{1}{12}$
$45\frac{5}{8}$

13. $28\frac{2}{3}$
$7\frac{3}{4}$

14. $4\frac{9}{10}$
$2\frac{3}{5}$

15. $1\frac{5}{16}$
$\frac{7}{8}$

Find the interest by the 60-day method:

16. $559 for 30 da.
17. $1760 for 15 da.
18. $480 for 37 da.
19. $780 for 81 da.
20. $390 for 21 da.
21. $498 for 15 da.

Solve:

22. $13' \times 14'\,6'' \times 7'\,8'' \div 27$
23. $16'\,9'' \times 1'\,3'' \times 8'\,6'' \div 24\frac{3}{4}$

Divide:

24. 24.2 ÷ .06
25. 18.75 ÷ .008
26. 8 ÷ .4
27. 10 ÷ .12
28. $12 ÷ .09
29. 16 ÷ .05

Change to per cents:

30. .205
31. 2.015
32. .005
33. 1.125

Round off to nearest thousandths:

34. 4.0268 **35.** .0054 **36.** 1.0156 **37.** .0999 **38.** 5.2678

By the 60-day method, find the interest at 6% on the following:

39. $1600 for 75 da.
40. $2450 for 6 da.
41. $1860 for 12 da.
42. $930 for 120 da.
43. $1232 for 15 da.
44. $4400 for 33 da.
45. $3200 for 18 da.
46. $7500 for 600 da.
47. $7000 for 300 da.
48. $5000 for 126 da.

Find the exact number of days between:

49. June 5—August 16.
50. Dec. 20—Feb. 20.

Chapter 19

Profit and Loss

UNIT 1

Markup on Cost

THE *net cost* of an item is the cost before certain expenses of doing business are added. After these expenses are added to the net cost, the result is called the *gross cost.* The difference between the net cost and the actual *selling price* is called the *gross profit* or *margin.* In this chapter the term *cost* will mean net cost unless otherwise stated, and the term *profit* will mean gross profit, unless otherwise stated. Thus, if a watch costs \$30 and sells for \$45, the profit is \$45 − \$30, or \$15. When expressed as a per cent, the profit is called the *markup.* The markup can be expressed as a per cent of the cost or of the selling price. Thus, \$15 is $\frac{15}{30} = 50\%$, which is the markup on cost, or $\frac{15}{45} = 33\frac{1}{3}\%$, which is the markup on selling price.

In this unit we shall study the markup on cost.

EXAMPLE 1. The Triangle Haberdashery buys men's shirts for \$3.00 and sells them for \$4.00. Find the markup on cost.

SOLUTION.

$$\begin{aligned}\text{Profit} &= \text{Selling Price} - \text{Cost}\\ &= \$4.00 - \$3.00 = \$1.00\\ \text{Markup on Cost} &= \tfrac{1}{3} = 33\tfrac{1}{3}\%\end{aligned}$$

EXAMPLE 2. Shoes costing \$8 are sold at a markup on cost of 25%. What is their selling price?

SOLUTION.

$$25\% \text{ of } \$8 = .25 \times \$8 = \$2.$$
$$\$2 + \$8 = \$10, \text{ selling price.}$$

Problems

GROUP 1

Find the markup on cost. Express your result to the nearest per cent.

	Cost	*Selling Price*		*Cost*	*Selling Price*
1.	$12	$20	**6.**	$ 2.75	$ 3.25
2.	$30	$40	**7.**	$ 3.40	$ 4.08
3.	$150	$200	**8.**	$ 8.50	$10.50
4.	$2	$3	**9.**	$ 3.22	$ 3.54
5.	$1.50	$2.00	**10.**	$18.54	$20.39

Compute the selling price.

	Cost	*Markup on Cost*		*Cost*	*Markup on Cost*
11.	$ 10	20%	**16.**	$640	12½%
12.	$ 15	30%	**17.**	$2.53	20%
13.	$ 27	33⅓%	**18.**	$18.72	10%
14.	$500	8%	**19.**	$21.83	40%
15.	$250	10%	**20.**	$302.86	5%

GROUP 2

1. The Radiant Appliance Co. buys electric toasters for $21.53 and sells them at $35. What is the markup on cost, to the nearest per cent?

2. A dealer bought an article for $25 and sold it at a markup on cost of 20%. What was the sale price of the article?

3. One dozen neckties cost $24. The markup on cost is 25%. Find the selling price of each necktie.

4. One dozen dresses cost $360. They sell for $45 each. What is the markup on cost?

5. Mr. Arnold Carter, a hardware merchant, buys hand saws at $3.10 and sells them for $4.50 each. What is the markup on cost, to the nearest per cent?

6. A piano costing $320 was sold at a gross profit of 25% of cost. What was the selling price?

7. A merchant bought an article invoiced at $12.50, less 4% discount, and sold it at a gross profit of 33⅓% on net cost. What was the selling price?

8. A machine was bought for $375, less 10% and 2%. The freight and cartage were $19.25. If the machine was sold at a gross profit of 40% on the gross cost, at what price was it sold?

9. A merchant bought 125 bbl. of potatoes at $4 a barrel. If 5 bbl. decayed, at what price per barrel must he sell the good potatoes to make a gross gain of 20% on the whole cost?

10. A merchant bought three pieces of cloth, containing 55 yd. each, for $115.50. He sold the cloth at retail for 95¢ a yard. Find the total gain and the per cent of gain on the cost.

11. An article was sold for $4.80, at a loss of 4% on cost. For what price should it have been sold in order to realize a gross profit of 25% on cost?

12. A dealer bought chairs for $8.40, less 12½% and 2%. At what price must he sell each chair to make a gross profit of 33⅓% on the net cost?

13. A manufacturer sold an article to a jobber for $60, less 25% discount; the jobber sold it to a retailer for $75, less 20% discount; and the retailer sold it to a consumer for $90, less 10% discount. (*a*) What per cent of gross profit did the jobber make? (*b*) What per cent of gross profit did the retailer make?

14. A dealer offered an article for sale for $160, at a gross profit of 33⅓% on cost. He finally accepted 10% less than the asking price. What was his per cent of gross profit?

15. A merchant bought 5 doz. folding stepladders at $21.60 a dozen, less 10% and 5%. By paying cash he received an additional discount of 1%. He paid $4.58 for cartage. At what price should each stepladder be marked in order that the merchant may make a gross profit of 25% on the gross cost?

UNIT 2

Markup on Selling Price

OFTEN the retail merchant expresses the markup as a per cent of the selling price. There are several reasons for doing this. For example, a certain grade of men's shirts may have a well-established sales price, such as $3.95. Since the selling price is fixed first, it is easier to compute the markup as a per cent of this amount. For example, the markup desired on men's shirts may be 20%. Then, 20% of $3.95 = .20 × $3.95 = $.79, profit. The cost would then be $3.16. If the dealer is able to buy these shirts for $3.16, he is able to maintain his desired markup.

EXAMPLE 1. If a shirt cost $3 and sells for $4, find the markup on the selling price.

SOLUTION.

$$\text{Profit} = \$4 - \$3 = \$1.$$
$$\text{Markup on selling price} = \tfrac{1}{4} = .25 = 25\%.$$

Example 2. The selling price of a suit of clothes is $50, and the markup on selling price is 25%. Find the cost.

Solution.

25% of $50 = .25 × $50 = $12.50, markup on selling price.

$50 − $12.50 = $37.50, cost.

Sometimes the cost and the markup on selling price are known, and it is desired to find the selling price.

Example 3. The cost of a sports coat is $40 and the markup on selling price is 20%. Find the selling price.

Solution.

Selling Price = 100%

Markup on Selling Price = 20%

Cost = Selling Price − Markup on Selling Price

Cost = 100% − 20% = 80%

80% of selling price = $40

$$1\% \text{ of selling price} = \frac{\$40}{80} = \$.50$$

100% of selling price = 100 × $.50 = $50.

Problems

Group 1

Find the markup on selling price:

	Cost	*Selling Price*		*Cost*	*Selling Price*
1.	$5	$8	**6.**	$350	$400
2.	$16	$20	**7.**	$8.70	$9.00
3.	$200	$300	**8.**	$24.50	$30.00
4.	$2.50	$3.00	**9.**	$500	$600
5.	$4.16	$4.92	**10.**	$.50	$.75

Find the cost price:

	Selling Price	*Markup on Selling Price*		*Selling Price*	*Markup on Selling Price*
11.	$ 20	10%	**16.**	$4.80	10%
12.	$ 30	20%	**17.**	$9.60	40%
13.	$ 45	33⅓%	**18.**	$.98	20%
14.	$ 24	12½%	**19.**	$3.95	15%
15.	$300	25%	**20.**	$34.75	35%

Find the selling price:

	Cost Price	*Markup on Selling Price*		*Cost Price*	*Markup on Selling Price*
21.	$40	20%	**26.**	$16.75	30%
22.	$6	25%	**27.**	$250	$16\frac{2}{3}\%$
23.	$90	25%	**28.**	$100	20%
24.	$440	10%	**29.**	$42.68	40%
25.	$2.98	10%	**30.**	$.81	20%

GROUP 2

1. A piano lamp was purchased for $37.50, less 20% discount. For how much must it be sold to make a gross profit of 25% on the selling price?

2. A merchant bought an article for $64.25, less 10% and 5% discounts. For how much must he sell it to realize a gross profit of $33\frac{1}{3}\%$ on the selling price?

3. The gross cost of an article is $13.02. For how much must it be sold to allow $17\frac{1}{2}\%$ of the selling price for the cost of selling and make a net profit of $12\frac{1}{2}\%$ on the selling price?

4. The net cost of a couch was $54.50. The buying expenses were 4% of the net cost. If the couch was sold at a gross profit of $14.17, what was the per cent of profit on the gross cost?

5. A dealer buys fountain pens at $36 a dozen, less 25% and 20%. The overhead of the store amounts to 25% of its sales. At what price must the dealer sell each pen in order to make a net profit of 15% on the selling price?

6. A merchant bought rugs at $27, less 25%. At what price must he mark them to make a gross profit of 20% on the selling price after allowing an advertised discount of $33\frac{1}{3}\%$ on the marked price?

7. The Star Clothing Shop bought an odd lot of men's clothing, consisting of 150 summer suits, for $2550. After the suits had been marked up 40% on the cost, 100 of them were sold. At what price must each of the remaining suits be sold in order to realize a gross profit of 25% on the cost of the entire lot?

UNIT 3

Averaging Markups

If the markups on the selling price in two or more departments of a retail store are given, it is not correct to average the markups in order to find the average markup. The reason for this lies in the fact that the individual markups are per cents of different numbers.

Instead of averaging the markups, it is necessary to proceed as in the following example.

EXAMPLE. The markup on sales in the shoe department is 30%, and the sales for July amounted to $15,000. The markup on sales in the men's department is 25%, and the sales for July amounted to $40,000. Find the average markup on sales for the two departments.

SOLUTION. 30% of $15,000 = $4500, profit in shoes.
25% of $40,000 = $10,000, profit in men's department.
$4500 + $10,000 = $14,500, total profit.
$15,000 + $40,000 = $55,000, total sales.
$\frac{14{,}500}{15{,}000} = .26\frac{4}{11} = 26\frac{4}{11}\%$, average markup.

Problems

GROUP 1

Find the average markup:

1. Markup on sales, 15%; sales, $5000.
Markup on sales, 10%; sales, $6000.

2. Markup on sales, 25%; sales, $12,000.
Markup on sales, 40%; sales, $5000.

3. Markup on sales, 30%; sales, $2000.
Markup on sales, 20%; sales, $3000.

4. Markup on sales, 20%; sales, $25,000.
Markup on sales, 10%; sales, $8000.

5. Markup on sales, 30%; sales, $3000.
Markup on sales, 20%; sales, $4000.
Markup on sales, 40%; sales, $8000.

6. Markup on sales, 15%; sales, $8000.
Markup on sales, 10%; sales, $20,000.
Markup on sales, 18%; sales, $3000.

GROUP 2

1. The Universal Department Store had the following sales and markups on sales for the month of December. Find the average markup for the entire store.

Shoes: sales, $20,000; markup, 30%.
Men's wear: sales, $80,000; markup, 25%.
Women's wear: sales, $70,000; markup, 20%.
Toys: sales, $100,000; markup, 40%.

2. The Bay City Sporting Goods Store had the following sales and markups for the past year. Find the average markup for the entire store.

Fishing equipment and supplies:
  Sales, \$80,000; markup, 40%.
Hunting equipment and supplies:
  Sales, \$120,000; markup, 30%.
Football, basketball, tennis, and track:
  Sales, \$60,000; markup, 25%.

3. The men's wear department in a certain store had sales of \$200,000 with a markup of 25%. The women's wear had sales of \$300,000. What should be the markup in women's wear so that the average for the two departments would be 27%?

4. The average markup in the Western Toggery is 28%, and the total sales amount to \$250,000. How much "leader merchandise" can be sold at a low markup of 5% in order to have a total average markup of 27%?

UNIT 4

Equivalent Markups

SOMETIMES the markup on the selling price is known, and it is desired to find the equivalent markup on cost price.

EXAMPLE 1. The markup on selling price of a chair is 20%. Find the equivalent markup on cost.

SOLUTION.

$$\begin{array}{r}100\% \text{ of selling price} = \text{Selling price}\\ \underline{-20\%} \text{ of selling price} = \text{Markup}\\ 80\% \text{ of selling price} = \text{Cost.}\end{array}$$

$$\text{Markup on cost} = \frac{20\%}{80\%} = \frac{.20}{.80} = \frac{1}{4} = .25 = 25\%.$$

If the markup on cost is known, and the equivalent markup on selling price is desired, we may proceed as follows.

EXAMPLE 2. The markup on cost of a davenport is 20%. Find the equivalent markup on selling price.

SOLUTION.

$$\begin{array}{r}100\% \text{ of the cost} = \text{Cost}\\ \underline{+20\%} \text{ of cost} = \text{Markup}\\ 120\% \text{ of cost} = \text{Selling price.}\end{array}$$

$$\text{Markup on selling price} = \frac{20\%}{120\%} = \frac{.20}{1.20} = \frac{1}{6} = 16\tfrac{2}{3}\%.$$

Problems

GROUP 1

Fill in the missing entries in this table of equivalent markups.

	Markup on Cost	*Markup on Selling Price*		*Markup on Cost*	*Markup on Selling Price*
1.	20%	——	**11.**	5%	——
2.	——	40%	**12.**	22%	——
3.	30%	——	**13.**	——	4%
4.	——	15%	**14.**	80%	——
5.	12½%	——	**15.**	——	45%
6.	33⅓%	——	**16.**	——	80%
7.	——	50%	**17.**	150%	——
8.	100%	——	**18.**	2.5%	——
9.	12%	——	**19.**	——	2.9%
10.	——	18%	**20.**	——	12½%

GROUP 2

1. A haberdasher bought shirts at $2.50 and sold them at a profit of 33⅓% of the cost. What per cent of the selling price was his profit?

2. A merchant sold a hat for $8, gaining 25% of the selling price. The gain is what per cent of the cost?

3. Ties bought at $1.50 each are sold at a profit of 66⅔% of the cost. The profit is what per cent of the selling price?

4. A store sold a pair of men's hose for $.75, thereby gaining 40% of the selling price. What per cent of the cost is the gain?

5. A dealer bought a radio for $155, F. O. B. Flint, Michigan. He paid $3.50 freight to the city in which he is located and $1.50 trucking charges to bring the radio from the railroad depot to his store. The selling price of the radio was $240. What per cent did he gain on the selling price and on the gross cost?

6. A merchant bought an article invoiced at $16, less 37½% discount, and sold it at a gross profit of 30% on net cost. What was the selling price?

7. A table cost $20. It was sold at a gross profit of 33⅓% of the selling price. Find the selling price.

8. A hat dealer buys hats at $45 per dozen, less 25% and 20%. To make a gross profit of 20% on the net cost and offer a special discount of 10% during a special sale, at what price must each hat be marked?

9. A retailer bought certain watches for $60 list, less 33⅓% and 25%, and sold them for the regular list price. What was the dealer's rate of gain on his cost?

10. In Problem 9, what was retailer's rate of gain on the selling price?

11. A merchant bought an article invoiced at $12.50, less 5% discount, and sold it at a gross profit of 33⅓% on cost. What was the selling price?

12. A machine was bought for $375, less 10% and 2% discounts. The freight and cartage were $19.25. If the machine was sold at a gross profit of 40% on the gross cost, at what price was it sold?

13. A merchant sold a suit for $27.50, gaining 20% of the selling price. How much is the gain? The gain is what per cent of the cost?

14. Sweaters bought at $20 a dozen are sold at a profit of 60% of cost. (*a*) How much is the profit on each sweater? (*b*) The profit is what per cent of the selling price?

15. A gain of 40% of the cost is a gain of what per cent on the selling price? Prove your answer with a practical problem.

UNIT 5

Marking Goods in Code

It is now the almost universal custom in the business world for articles which are offered for sale to be marked clearly with the selling price, so that there can be no question about it. In the retail trade this practice is followed for two reasons. The absence of marking on merchandise keeps away timid people who are interested but are afraid to ask the price lest it be too high, and it may also arouse suspicion in other people that the price quoted is not always the same.

It is, however, the practice in some trades and in some organizations to mark the merchandise offered for sale also with the cost price. Knowing the cost of everything, without having to refer back to original records, is useful in computing markdowns for clearance sales, taking inventory, placing reorders, and so on. Obviously, however, the cost price is not meant for the customer's eyes, and so it is written in a *code* that is unintelligible to all but the people responsible for setting, marking, and recording prices.

Cost Price in Code

Example 1. A haberdasher buys shirts for $1.80 each and sells them for $2.50 each. How are these two prices marked on the labels?

Any word or phrase having ten different letters may be used as a code. The following are examples:

W	A	N	D	E	R	L	U	S	T
1	2	3	4	5	6	7	8	9	0

Repeater, X

Y	O	U	C	A	N	L	I	V	E
1	2	3	4	5	6	7	8	9	0

Repeater, Z

The repeater is used when two figures coming together in a price are the same. If the first code, "*wanderlust,*" is used, the cost price, \$1.80, is written *W.UT*. If the second code, "*you can live,*" is used, it is written *Y.IE*.

Example 2. The haberdasher in Example 1 marked other merchandise items by the code "*wanderlust*" as follows:

$$\frac{\text{DU.TX}}{\$55.00} \qquad \frac{\text{E.TX}}{\$7.50}$$

Write the costs in figures.

Solution.		
	D – 4	E – 5
	U – 8	T – 0
	T – 0	X – 0
	X – 0	
	Cost = \$48.00	Cost = \$5.00

Cost and Selling Price in Code

Sometimes codes are used to mark both the cost and the selling price.

Example 3. How would the shirts mentioned in Example 1 be marked if cost and selling price are written in code?

Two codes can be used at the same time. If the code "*wanderlust*" is used for the cost price, and the code "*you can live*" is used for the selling price, the shirts would be marked thus:

$$\frac{\text{W.UT}}{\text{O.AE}}$$

There is no limit to the selection and arrangement of codes for price marking. As a means of making it more difficult for the customer to determine the code marking, a word like *wanderlust* may be arranged backwards:

T	S	U	L	R	E	D	N	A	W
1	2	3	4	5	6	7	8	9	0

Problems

Group 1

Using the code word "purchasing" *with* x *as a repeater for the cost price and the code phrase* "white board" *with* q *as a repeater for the selling price, give the cost and selling price of each of the following:*

	Cost	*Rate of Gain on Cost*		*Cost*	*Rate of Gain on Cost*
1.	$36	12½%	**5.**	$2.20	15%
2.	$428	25%	**6.**	$16.50	20%
3.	$360	8⅓%	**7.**	$3.60	16⅔%
4.	$1.04	12½%	**8.**	$49	$14\frac{2}{7}$%

Group 2

Using the code word "wanderlust" *with* x *as a repeater for the cost price and the code phrase* "you can live" *with* z *as a repeater for the selling price, mark the prices of the following in the form* $\frac{\text{Cost Price}}{\text{Selling Price}}$:

	Cost Price	*Selling Price*		*Cost Price*	*Selling Price*
1.	$3.25	$5	**4.**	$33.20	$47.50
2.	$7.14	$9.75	**5.**	$66.10	$92
3.	$15.80	$22.50	**6.**	$157.25	$225

Using the codes given above, state the following prices in figures:

7. $\frac{\text{A.NE}}{\text{U.AE}}$ **8.** $\frac{\text{D.RU}}{\text{N.LA}}$ **9.** $\frac{\text{DE.RT}}{\text{NE.ZZ}}$ **10.** $\frac{\text{WNE.RT}}{\text{YVA.ZE}}$

Chapter Test—Review

Group 1

Find the gain on each item:

	Selling Price	*Cost*		*Selling Price*	*Cost*
1.	$2870	$2214	**4.**	$3734	$3158
2.	$1896	$1372	**5.**	$9217	$7176
3.	$849	$586	**6.**	$4125	$3672

7. Find the total gain in Problems 1–3.

Find the rate of gain on cost and the rate of discount:

	Marked Price	*Selling Price*	*Cost*
8.	$90	$75	$50
9.	$40	$36	$24

Using the code word "wanderlust," *with* y *as a repeater, for the cost price and the words* "you can live," *with* x *as a repeater, for the selling price, give the cost and selling price of each of the following:*

	Cost	Rate of Profit on Cost		Cost	Rate of Profit on Cost
10.	$32	25%	**11.**	$98	14$\frac{2}{7}$%

Using the codes given above, state the following prices in numbers:

12. $\frac{\text{W.AR}}{\text{O.EX}}$ **13.** $\frac{\text{A.YE}}{\text{U.AE}}$ **14.** $\frac{\text{N.LE}}{\text{C.AE}}$ **15.** $\frac{\text{R.US}}{\text{V.CA}}$

Find the selling price:

	Cost	*Net Profit*	*Cost of Doing Business*
16.	$4.80	25% of selling price	15% of selling price
17.	$21	20% of selling price	10% of selling price

Group 2

1. A dealer bought 900 bu. of potatoes for $1.40 a bushel. During the time he kept them, 10% decayed. He sold the good potatoes for an average of $1.95 a bushel. Did he gain or lose, and how much?

2. The population of a city has increased 28% in the last 10 years. If it is 47,520 now, what was it 10 years ago?

3. A merchant's sales were $42,600 during the first year; they increased 27$\frac{1}{2}$% during the second year; and in the third year they were $60,832.80. (*a*) What were his sales during the second year? (*b*) What was the percentage of increase of his sales in the third year over those in the second year?

4. A gain of 50% of the cost is a gain of what per cent on the selling price? Prove your answer by assuming the cost to be $600.

5. At what selling price must linoleum costing $2.80 per square yard be marked in order to make a gross profit of 50% on cost and allow trade discounts of 20% and 12$\frac{1}{2}$%?

6. Goods listed at $2 and bought at a discount of 40% must be marked at what price to gain 33$\frac{1}{3}$% on cost and allow a discount of 20%?

Speed Drills in Fundamentals

Test 15

1–10. Find the totals by days and by departments:

Day	*Haberdasher*	*Shoes*	*Hats*	*Suits*	*Totals*
Monday...........	$345.68	$876.43	$972.46	$938.76	——
Tuesday...........	724.87	879.87	724.89	478.76	——
Wednesday........	954.38	347.86	932.47	832.97	——
Thursday..........	648.76	498.76	598.76	458.72	——
Friday............	459.87	246.89	724.89	769.78	——
Saturday..........	983.21	398.72	729.79	325.89	——
	———	———	———	———	

Add:

11. $\begin{array}{l} \text{5 bu. 3 pk.} \\ \underline{\text{2 bu. 4 pk.}} \end{array}$

12. $\begin{array}{l} \text{5 doz. 8 units} \\ \underline{\text{3 doz. 10 units}} \end{array}$

13. $\begin{array}{l} \text{4 yr. 9 mo.} \\ \underline{\text{6 yr. 11 mo.}} \end{array}$

Subtract:

14. $\begin{array}{r} 527835 \\ \underline{70846} \end{array}$

15. $\begin{array}{r} 69843 \\ \underline{28564} \end{array}$

16. $\begin{array}{r} 230568 \\ \underline{120479} \end{array}$

Multiply:

17. $260 \times 14\frac{1}{2}$¢

18. $352 \times 18\frac{1}{8}$¢

19. 66×5.5¢

20. $157{,}000 \times 0.7$¢

21. $.982 \times \$1.75$

22. $3450 \times \$2.45$ per M

Divide:

23. $6\overline{)18473}$

24. $9\overline{)22651}$

25. $7\overline{)88479}$

26. $\frac{3}{4} \div \frac{5}{8}$

27. $6\frac{1}{2} \div \frac{7}{8}$

28. $12\frac{1}{2} \div 4\frac{3}{4}$

Find:

29. 63% of \$3521

30. $8\frac{1}{4}$% of \$1792

31. $4\frac{1}{2}$% of \$176.25

32. $112\frac{1}{2}$% of \$360

33. 250% of \$165

34. $\frac{1}{4}$% of \$214.35

Complete:

35. 80 is ____% of 1000.

36. ____% of 90 is 30.

37. 42 is ____% of 252.

38. ____% of 15 is 5.

Find the missing number:

39. 35% more than \$40 is \$____.

40. 20% less than \$100 is \$____.

41. A 30% loss on \$12.50 leaves \$____.

42. A 15% discount on \$37.50 leaves \$____.

43. Two successive 10% increases on \$2500 make a total of \$____.

44. Two successive 10% discounts on \$2500 leave \$____.

45. Successive discounts of 20%, 10%, and 5% on \$300 leave \$____.

46. Two successive 10% discounts on \$5000 equal a single discount of ____%.

47. 15% more than \$150 equals \$____.

48. 20% less than \$200 equals \$____.

49. A 25% increase on a salary of \$300 totals \$____.

Chapter 20

Business Partnerships

UNIT 1

Distribution of Partnership Profits Equally, According to Agreed Profit-and-Loss Ratio, and According to Capital Ratio at Beginning of Period

ONE of the advantages of a single proprietorship is that the owner can set his own policies, carry them out, and keep all the profits. But, as the business increases in size, the single proprietor may find that his capital is not sufficient to enable him to handle all the business, or his time may be so broken up that he is unable to give the required amount of attention to the office, the factory, and the sales department. For these reasons he may find it advisable to join with another, or others, in a *partnership.* The additional capital obtained through the formation of a partnership enables the business to operate on a larger scale, and the new partners provide a more efficient management of the various functions of the business. A partnership, therefore, offers many advantages over a sole proprietorship.

A Copartnership Agreement

John Baltus, the owner of a good tool-shop business, was an excellent inside manager, but he felt that he would have a much more profitable enterprise if he could combine his abilities with those of an experienced salesman. He therefore decided to enter into a partnership agreement with Ronald Keene. The two men went to the office of an attorney to arrange the details of the copartnership agreement. The attorney told them that one of the most important clauses of the agreement is the one relating to the distribution of profits. He then outlined the following five possible methods of profit distribution: (1) Equal distribution, (2) distribution according to agreed profit-and-loss ratio, (3) distribution according to capital ratio, (4) distribution according to average investment, (5) distribution allowing interest on investment with the balance divided according to profit-and-loss ratio. The attorney also explained that, if no agreement as to profits and losses is made, the law assumes that they will be divided equally. The first three methods of dividing profits will be explained in this lesson.

Equal Division of Profits

Example 1. Mr. Baltus invested $15,000, and Mr. Keene invested $20,000 in their partnership. If the partnership agreement provided that profits and losses be shared equally, what was each partner's share of the first year's profit of $3600?

Solution. This problem can be solved mentally. It is evident that each partner's share of the profit is $1800, even though their investments are unequal.

When two partners invest some money in a business, and one of them, because of his broad experience or the type of service that he performs, is considered more valuable to the firm, the partners may agree to share the profits in a ratio different from the equal distribution assumed in Example 1.

Division of Profits in Agreed Ratio

Example 2. Mr. Baltus and Mr. Keene agreed to divide profits and losses in a ratio of 60% to Mr. Baltus and 40% to Mr. Keene. If the profits for the year were $4200, what was each partner's share?

Solution.

$4200 × .60 = $2520, Mr. Baltus's share.
$4200 × .40 = $1680, Mr. Keene's share.

Proof.

$2520 + $1680 = $4200, total profits.

Division of Partnership Profits According to Capital Ratio at Beginning of Period

Example 3. Evans and King formed a partnership, Evans investing $3500 and King investing $1500. Profits for the year were $3600. If the partners agreed to divide the profits and losses according to the capital ratio at the beginning of the period, what was each partner's share?

The easiest way to find the amount that each partner should receive when profits are divided according to capital ratio is as follows:

1. Find the total capital or investment at the beginning of the period.

2. Use the individual investment of each partner as a numerator and the total capital of the firm as a denominator to form fractions representing the partners' shares of the total partnership profits.

3. Multiply these fractions by the total profits.

SOLUTION.

$$\$3500 + \$1500 = \$5000, \text{ total investment.}$$

$$\frac{\$3500}{\$5000} = \frac{7}{10}$$

$$\frac{7}{10} \times \$3600 = \$2520, \text{ Evans's share.}$$

$$\frac{\$1500}{\$5000} = \frac{3}{10}$$

$$\frac{3}{10} \times \$3600 = \$1080, \text{ King's share.}$$

PROOF.

$$\$2520 + \$1080 = \$3600, \text{ total profit.}$$

Problems

GROUP 1

Find the missing elements in the following:

	Profit	*Agreed Division of Profit* A	B	*A's Share*	*B's Share*
1.	$ 500	Equally			
2.	$ 600	30%	70%		
3.	$ 800	25%	75%		
4.	$1500			$500	$1000
5.	$6260	Nothing in agreement			

Assuming that profits and losses are divided according to capital ratio at the beginning of the period, find the missing elements in the following:

	Capital at Beginning of Period A	B	C	*Profit*	*A's Share*	*B's Share*	*C's Share*
6.	$1000	$ 500	——	$ 600			
7.	$2000	$2000	$1000	$1500			
8.	$2000	$5000	$3000	$4000			
9.	$ 250	$ 750	$ 500	$1200			

GROUP 2

1. Martin and Henderson invested $20,000 each in a lumber business. The net profit during the first year was $9200. Find each partner's share of the profit.

2. Rice and Moore invested $15,000 each in a hardware business two years ago. During the first year, their net loss was $2640. During the second year, their net gain was $5620. What is the present worth of each partner? (Present worth equals original investment plus profit minus loss.)

3. *F*, *G*, and *H* formed a partnership. *F* invested $15,000; *G* invested $18,000; and *H* invested $12,000. (*a*) What per cent of the capital did each one invest? (*b*) What part of an $8700 profit should each partner receive if profits are divided in a ratio of 30%, 40%, and 30%?

4. Dolan, Evans, and Farrel entered into a partnership, investing $12,000, $16,000, and $22,000, respectively. The first year, their net profit was $9600, which was divided in proportion to investments. Find the amount of profit each partner earned.

5. Manning and Moore engaged in the grocery business. Manning invested $4000, and Moore invested $3000. The net profit for the year was $5200. If each partner drew a salary of $100 per month, and the remainder of the net profit was divided in proportion to the respective investments, how much should each partner earn?

6. Two partners paid $32,000 for a canning business. *C* paid $12,000, and *D* paid the remainder. They operated the plant for one year at a net profit of $7400 and then sold out their interest in the business for $50,000. What was each partner's share of both profits if the profits were divided in proportion to their investments?

UNIT 2

Distribution of Partnership Profits According to Average Investment

In this lesson we shall discuss the fourth of the methods of distributing partnership profits and losses mentioned in Unit 1.

Example 1. Marvin and Clyde formed a partnership, Marvin investing $5000 and Clyde investing $10,000. During the year, Marvin made an additional investment of $3000. The profits for the year were $5700. What was each partner's share if, according to their agreement, profits were to be divided in proportion to their original investments?

Solution. This problem is solved exactly like Example 3 of Unit 1. Marvin's share of the profits is $1900, and Clyde's is $3800.

Why is this an unfair distribution of profits? What can be done to equalize this obvious unfairness? The solution to the following problem suggests an answer to this question.

Example 2. James Alcott and Daniel Buxton are partners in a public garage and automobile service station. On July 1, 1952, Alcott invested $4000, and Buxton invested $3000. On Nov. 1, Alcott invested an additional $1000, and Buxton invested $1500. On Mar. 1, 1953, Alcott withdrew $500. On Apr. 1, each partner invested an additional $1000. The net profit for the fiscal year was $2736. What is each partner's share, if profits and losses are divided in proportion to the *average* investments?

All the facts can be seen at a glance if they are set up in the form of ledger accounts, as shown below. Each partner is credited with his investments and charged with his withdrawals.

James Alcott's Capital

1953			1952		
Mar. 1.	Withdrawal	$500.00	July 1	Investment	$4000.00
			Nov. 1	Additional investment	1000.00
			1953		
			Apr. 1	Additional investment	1000.00

Daniel Buxton's Capital

			1952		
			July 1	Investment	$3000.00
			Nov. 1	Additional investment	1500.00
			1953		
			Apr. 1	Additional investment	1000.00

First Solution. *James Alcott's Investment:*

$4000 for 4 mo. is equal to $16,000 for 1 mo.
5000 for 4 mo. is equal to 20,000 for 1 mo.
4500 for 1 mo. is equal to 4500 for 1 mo.
5500 for 3 mo. is equal to 16,500 for 1 mo.
Total investment is equal to $57,000 for 1 mo.

$57,000 ÷ 12 = $4750, Alcott's average investment.

Daniel Buxton's Investment:

$3000 for 4 mo. is equal to $12,000 for 1 mo.
4500 for 5 mo. is equal to 22,500 for 1 mo.
5500 for 3 mo. is equal to 16,500 for 1 mo.
Total investment is equal to $51,000 for 1 mo.

$51,000 ÷ 12 = $4250, Buxton's average investment.
$4750 + $4250 = $9000, total average investment.
$\frac{4750}{9000} \times \$2736 = \$1444$, Alcott's share of profits.
$\frac{4250}{9000} \times \$2736 = \$1292$, Buxton's share of profits.

The work can be shortened by completing the problem as follows:

$57,000 + $51,000 = $108,000, total investment for 1 mo.
$\frac{57{,}000}{108{,}000} \times \$2736 = \$1444$, Alcott's share of profits.
$\frac{51{,}000}{108{,}000} \times \$2736 = \$1292$, Buxton's share of profits.

Also observe that months are usually taken for the periods of time; as a rule, changes in investments are made at intervals of months, or at periods approximating them so nearly that months are used. If investment changes take place at irregular intervals, it is necessary to express the periods in days.

SECOND SOLUTION. *James Alcott's Investment:*

Investment Date	*Amounts*	*Months Invested*		*Dollar-Month Product*	*Total*
July 1	$4000	12	48,000		
Nov. 1	1000	8	8000		
Apr. 1	1000	3	3000		
				59,000	
	Withdrawal				
Mar. 1	$ 500	4	2000	2000	
	Capital in dollar-months				57,000
	Daniel Buxton's Investment:				
July 1	$3000	12	36,000		
Nov. 1	1500	8	12,000		
Apr. 1	1000	3	3000		
	Capital in dollar-months				51,000
	Total capital in dollar-months				108,000

$\frac{57}{108} \times \$2736 = \$1444$, Alcott's share of profits.
$\frac{51}{108} \times \$2736 = \$1292$, Buxton's share of profits.

Rule. To find each partner's share of profits on the basis of average investment, proceed as follows: (1) Multiply the capital invested by the number of months it remains unchanged. (2) Repeat this process for each change in the amount of capital during the year. (3) Find the sum of the products found in the first two steps. (4) Divide this sum by the total number of months to obtain the average investment. (5) Add the average investments of the partners. (6) Multiply the profit by the fractions formed by placing the individual average investments of the partners over the total average investment.

The fourth step may often be eliminated, and in the sixth step the totals instead of the average investments may be added.

Problems

GROUP 1

1. If *A* invested $100 for 4 mo. and $400 for 8 mo. in a partnership, what is his average investment for the year?

2. Kane's average investment is $1500, and Smith's average investment is $4500. If the profit for the period is $2400, how much will each receive?

3. *A* and *B* have been in business for 3 years. At the beginning of the first year, *A*'s capital was $1000. At the beginning of the second year, *A*'s capital increased to $1500. At the beginning of the third year, *A*'s capital increased to $2000. What is the amount of *A*'s average investment for the 3 years?

4. You are told that Grey's average investment is equal to one-third of Frank's average investment. If the profits at the end of the year are $4800, how much will each receive?

5. If $100 for 30 days equals $3000 for 1 day, and $200 for 20 days equals $4000 for 1 day, what is the average investment for 1 month?

GROUP 2

1. On Jan. 1 M. E. Kirk and J. E. Marsh engaged in the automobile accessory business. Kirk invested $15,000, and Marsh invested $20,000. On July 1 each partner invested $2500 additional. The profits for the year were $7125. (*a*) Find each partner's share if the profits are to be divided on the basis of average investments. (*b*) Find each partner's present worth.

2. Madison and Moore are partners in a plumbing business. On May 1 Madison invested $9000 and Moore invested $6000. On Nov. 1 Madison invested $1000 additional and Moore invested $1500 additional. After all expenses and salaries are paid, the net profit for the fiscal year ending May 1 is $3981.25. Find each partner's present worth if net profits are to be divided on the basis of average investments.

3. *G* and *H* are partners in conducting a chain of ten grocery stores.

On Apr. 1 *G* invested \$25,000 and *H* invested \$20,000. On July 1 *G* invested \$5000 additional and *H* invested \$10,000 additional. On Oct. 1 *G* withdrew \$2000 and *H* withdrew \$1000. The profit and loss statement for the fiscal year ending Apr. 1 showed a net profit of \$8212.50. What was each partner's share on the basis of his average investment for the 12 months?

4. (*a*) In Problem 3, what would have been each partner's share if profits were divided in a ratio of 60% and 40%? (*b*) What would have been each partner's share if profits were divided according to investment at the beginning of the fiscal period? (*c*) Under which plan does *G* get the most profit? (*d*) Would you suggest to *G* that he have the plan for dividing profits modified? Why?

UNIT 3

Distribution of Partnership Profits by Allowing Interest on Investment and Dividing Balance Equally

THE AVERAGE investment and capital ratio methods of dividing profits in a partnership are both open to criticism. Under either of these two methods of distribution, the bulk of the profits goes to the one who has the most money invested. This does not give sufficient recognition to the special abilities of the partners or to the time spent, both or either of which may be important factors in the success of a business. To give due recognition to capital invested, special skills, and service to the business, a method of distribution combining interest on investment and an agreed profit-and-loss ratio is used.

Interest on Partners' Capital Investment

EXAMPLE 1. Edward Waterson and Adrian Cole invested \$20,000 and \$10,000, respectively, in a manufacturing business. It was agreed that profits would be divided as follows: Interest would be allowed on invested capital at the rate of 6%, and the balance of the profits would be shared equally. At the end of the year, the profits of the partnership were \$5200 Determine each partner's share.

SOLUTION.

\$20,000 × .06 = \$1200, interest for 1 yr. on Waterson's investment.
\$10,000 × .06 = \$ 600, interest for 1 yr. on Cole's investment.
\$1200 + \$600 = \$1800, total interest.
\$5200 − \$1800 = \$3400, balance of profits.
\$3400 ÷ 2 = \$1700, each partner's share of balance of profits.
\$1200 + \$1700 = \$2900, Waterson's share of profits.
\$600 + \$1700 = \$2300, Cole's share of profits.

Interest on Partners' Average Investment

Profits may be divided equally after interest is allowed on *average* investment, as illustrated in the following problem.

EXAMPLE 2. Kirk and Marsh are copartners and share profits equally after 6% interest is allowed on average investment. On Jan. 1 Kirk's net worth was $72,000 and Marsh's was $63,000. Kirk withdrew $3000 on July 1 and made an additional investment of $1200 on Nov. 1. On Aug. 1 Marsh withdrew $1800. The profits for the year amounted to $37,090. What was each partner's share?

SOLUTION. *Kirk's Investment:*

$72,000 for 6 mo. is equal to $432,000 for 1 mo.
69,000 for 4 mo. is equal to 276,000 for 1 mo.
70,200 for 2 mo. is equal to 140,400 for 1 mo.
Total investment is equal to $848,400 for 1 mo.

$848,400 ÷ 12 = $70,700, average investment
$70,700 × .06 (or $707 × 6) = $4242, interest on average investment.

Marsh's Investment:

$63,000 for 7 mo. is equal to $441,000 for 1 mo.
61,200 for 5 mo. is equal to 306,000 for 1 mo.
Total investment is equal to $747,000 for 1 mo.

$747,000 ÷ 12 = $62,250, average investment.
$62,250 × .06 (or $622.50 × 6) = $3735, interest on average investment.

Division of Profits:

$4242 + $3735 = $7977, total interest.
$37,090 − $7977 = $29,113, balance of profits.
$29,113 ÷ 2 = $14,556.50, each partner's share of balance of profits.
$4242 + $14,556.50 = $18,798.50, Kirk's share of profits.
$3735 + $14,556.50 = $18,291.50, Marsh's share of profits.

Rule. A method of distributing partnership profits that takes into consideration both the investments of capital and the individual abilities of the partners is the combination of interest on investment with a profit-and-loss ratio. To divide partnership profits by this method, proceed as follows: (1) Determine the interest on each partner's investment. (2) Subtract the total interest allowed from the total profits. (3) Divide the balance of the profit between the partners in the agreed profit-and-loss ratio. (4) Add the interest allowed each partner to his share of the balance. Partnership profits may be divided equally after interest is allowed on average investment.

Chapter Test—Review

GROUP 1

1. *A* invested $1000 and *B* invested $500 in a partnership. If 6% interest is allowed on each investment, how much interest will each partner receive at the end of 1 year?

2. How much will each of the partners in Problem 1 receive in addition to the interest on his investment if the net profits for the year, prior to interest deductions, are $1090? Profits are to be divided as follows: 40% to *A* and 60% to *B*.

3. *A* and *B* invested $10,000 each in a business. The partnership agreement provided that the profits or losses were to be divided equally after each partner received 5% on his investment. If the profit for one year is $5000, how much interest will be deducted? How much of the remaining sum will each receive?

4. Jackson is a member of the firm of Hewes & Jackson. His investment at the beginning of the year was $5000. What is his investment at the end of the year if he receives 6% on his investment and, in addition, 30% of the balance of profits? The profits, after the interest on the partners' investments has been deducted, are $2300.

5. In order to compensate *X* for his excess investment, the partnership agreement between *X* and *Y* provides that *X* is to be paid 5% interest on the difference between *X*'s and *Y*'s investments. If *X* invested $5250 and *Y* invested $3750 in the business, how much interest will *X* receive?

6. In return for an investment of $5000, King is to receive a one-third share of the balance of profits and 5% on his original investment. At the end of one year, King is given a check for $1250. What profit did the business show after interest on partners' investments was deducted?

GROUP 2

1. *A*, *B*, and *C* are partners in a business which shows a profit of $15,428.40 for the year. *A*'s investment is $12,000; *B*'s is $16,000; and *C*'s is $20,000. After 6% interest on each partner's investment was deducted from the profit, the remainder was shared equally. Find each partner's share.

2. *A* invested $8000 and *B* invested $12,000 in a partnership. Interest is to be allowed on the investments at 6%, and the balance of profits is to be shared equally. During the year the partnership's gross gain was $12,840, and losses amounted to $3410. (*a*) Find the net gain. (*b*) Find the present worth of the firm. (*c*) Find each partner's present worth.

3. Three partners gained $37,600 in 2 years. *A* invested $20,000; *B* invested $24,000; and *C* invested $16,000. After each partner was allowed

6% interest on his investment, the balance of the gain was divided equally among the partners. How much did each partner receive?

4. *D*, *E*, and *F* are partners in a business which shows a profit of $15,780 for the year. *D* invested $9500; *E* invested $12,000; and *F* invested $8500. After 6% interest on each partner's investment for the year has been deducted from the profit, the remainder is divided in proportion to the partners' investments. Find each partner's share.

5. Madison and Moore are partners in a plumbing business. On May 1 Madison invested $9000, and Moore invested $6000. On Nov. 1 Madison invested $1000 additional, and Moore invested $1500 additional. Interest at 6% is allowed on each partner's average investment. After all expenses are paid, the net profit for the year, including the interest on each partner's investment, is $3981.25. Find each partner's present worth.

6. On Jan. 1 Clark, Brown, and Ryan entered into a partnership. Clark invested $6000; Brown invested $4500; and Ryan invested $7500. Clark and Brown made additional investments of $1500 each on July 1, and Ryan withdrew $500 on Aug. 1. It was agreed that each partner should receive 6% annually on his average investment and that the remaining profit or loss should be divided equally among the partners. At the end of the year, the gross profit on sales amounted to $6975, and other income amounted to $623. The expenses for the year were $2252. (*a*) Find the firm's net profit for the year. (*b*) Find each partner's total income for the year. (*c*) Find the present worth of the firm.

Speed Drills in Fundamentals

Test 16

Add:

1.	2.	3.	4.
$975.23	$633.25	$899.64	$673.52
872.98	544.87	125.37	678.58
368.79	963.42	568.98	453.52
482.42	852.76	382.84	268.57
296.54	539.87	632.75	676.17
848.85	329.64	969.68	745.29

5.	6.	7.
$6\frac{1}{2}$	25	$1284\frac{1}{2}$
8	$12\frac{3}{4}$	$3781\frac{3}{4}$
$7\frac{1}{4}$	$15\frac{1}{2}$	$5687\frac{1}{8}$
$5\frac{1}{2}$	$18\frac{1}{8}$	$8483\frac{7}{8}$
$7\frac{3}{4}$	$5\frac{1}{2}$	$7689\frac{5}{16}$
4	$7\frac{1}{4}$	$584\frac{1}{2}$

Subtract:

8. $\begin{array}{r}7\frac{2}{3}\\ 4\frac{3}{4}\\ \hline\end{array}$ **9.** $\begin{array}{r}2\frac{5}{6}\\ \frac{11}{12}\\ \hline\end{array}$ **10.** $\begin{array}{r}6\frac{7}{10}\\ 3\frac{5}{8}\\ \hline\end{array}$ **11.** $\begin{array}{r}8\frac{1}{8}\\ 2\frac{5}{6}\\ \hline\end{array}$ **12.** $\begin{array}{r}5\frac{1}{2}\\ 2\frac{3}{4}\\ \hline\end{array}$

Multiply:

13. $320 \times .03\frac{1}{8}$
14. $72 \times 16\frac{2}{3}$
15. $164 \times .06\frac{1}{4}$
16. 898×432
17. $\frac{2}{3} \times 285\frac{1}{4}$
18. $4.65\frac{1}{2} \times 1.25\frac{1}{4}$
19. 65 ft. × $8\frac{3}{4}$ ft.
20. $92\frac{1}{2}$ × \$2.75

Divide:

21. $5\overline{)14 \text{ hr. } 20 \text{ min.}}$
22. $8\overline{)600 \text{ ft.}}$
23. $3\overline{)20 \text{ lb. } 4 \text{ oz.}}$
24. $7\overline{)60 \text{ qt.}}$

Change to decimal fractions:

25. 10%
26. .05%
27. 115%
28. 68%
29. $87\frac{1}{2}\%$
30. 120%
31. .4%
32. $9\frac{1}{11}\%$

Find the missing numbers:

33. 28 is 7% of ____.
34. 40 is $116\frac{2}{3}\%$ of ____.
35. $\frac{1}{2}\%$ of ____ is 24.
36. 150% of ____ is 60.
37. 200% of ____ is 60.
38. $37\frac{1}{2}\%$ of ____ is 240.

Solve:

	Cost	*Rate of Gain on Cost*	*Selling Price*
39.	\$120	$12\frac{1}{2}\%$	______
40.	\$500	20%	______
41.	37.50	10%	______
42.	1.75	15%	______
43.	4.00	$8\frac{1}{3}\%$	______
44.	10.00	25%	______
45.	24.00	______	\$ 30.00
46.	150.00	______	162.50
47.	8.50	______	9.35
48.	16.00	______	18.00
49.	49.50	______	63.35
50.	12.00	______	13.80

Chapter 21

Stocks and Bonds

UNIT 1

Stocks as an Investment—Buying and Selling Stocks

MATTHEW A. HARPER wishes to invest some money in stocks in order to obtain a better return on his money than either a savings account or bonds would give him. He turns to the financial pages of the newspaper and looks at the quotations of the New York Stock Exchange. The following are some of the stocks that he finds listed:

SELECTED QUOTATIONS FROM NEW YORK STOCK EXCHANGE TRANSACTIONS

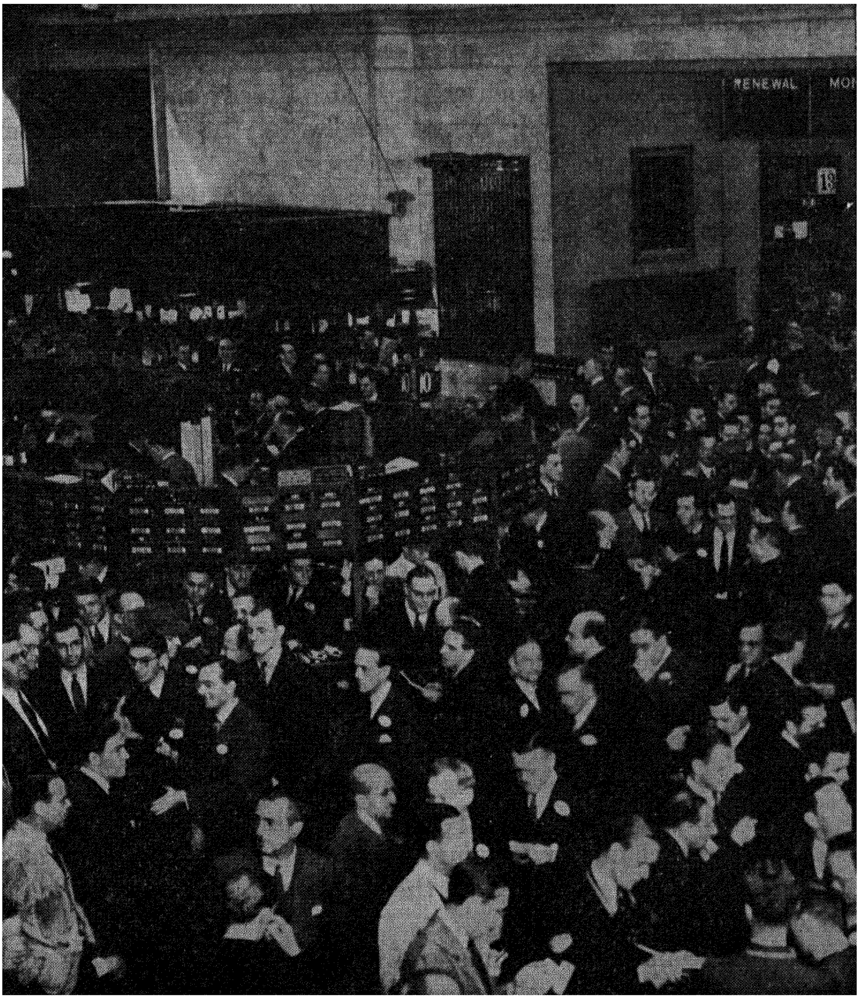
Stock	*High*	*Low*	*Close*	*Net Change*
Armour & Co.	12	11⅜	11⅞	+½
Bethlehem Steel 4	49⅝	49¼	49⅜	+¼
DuPont 4½ pf	117⅛	117⅛	117⅛	...
General Mills 2a	55½	55	55½	−¼
Madison Square Garden ½g	8⅝	8⅝	8⅝	...
Ohio Oil ¾e	55¼	54	54⅞	+⅜
Radio Corp. pf 3½	77	77	77	+1
Standard Brands 1.60	24¼	24	24⅛	+⅛
Union Pacific 5a	109¾	109¼	109¼	−½
U.S. Rubber 1½e	79	78¼	78⅜	+¼

Rates of dividend in the foregoing table are annual disbursements based on the last quarterly or semiannual declaration. Unless otherwise noted, special or extra dividends are not included.

a—Also extra or extras.
e—Declared or paid so far this year.
g—Paid last year.

In order to understand the quotation listed, Mr. Harper would have to know something about corporations, the stocks they issue, and the buying and selling of these securities on the various stock exchanges of the country. Let us examine these points.

Two classes of stock are issued by corporations in order to get the necessary capital to operate their businesses. The first of these, *common stock*, is the regular stock of the corporation. It is given no preference in the distribution of profits or assets. If a dividend has been declared in the last period, the stock will be listed on the financial page with a number beside it. This number denotes the



Courtesy of Gottscho-Schleisner

Trading Floor, New York Stock Exchange.

amount in dollars paid to stockholders in the last dividend period. For example, the second listing in our table is "Bethlehem Steel 4," which means that $4 was paid to the owners of this stock for every share held.

The absence of a number beside the name of the stock does not mean that the stock pays no dividend but that no dividend was declared during the last period. No dividend can be paid on common stock until such a dividend has been first paid on the preferred stock.

Preferred stock is a stock that carries with it an agreement that a stated dividend, or percentage of its par value, will be paid before any dividend is paid on any other kind of stock. In case the business is to be dissolved, such stock is also given preference in the distribution of assets. The letters *pf* following the name of a stock indicate that the stock is a preferred stock.

For example, "DuPont 4½ pf" means that this stock pays a 4½% dividend on a stock which has a par value of $100. It therefore pays $4.50 per share.

Questions

1. What does the "2a" mean in "General Mills 2a"?
2. What was the opening quotation on Armour & Co.?
3. What does the "1½e" mean on "U.S. Rubber 1½e"?
4. What was the opening quotation on Radio Corp.?
5. What does the *pf* mean on "Radio Corp. pf 3½"?
6. What does the "¾e" mean in "Ohio Oil ¾e"?
7. Which of the stocks in the list are preferred stocks?
8. What does the "g" mean in "Madison Square Garden ½g"?
9. How much dividend was paid by Union Pacific?
10. How can you account for the fact that Low and Close on U.S. Rubber differ by ⅛ and yet the net change was +¼?

In order to acquire any of these stocks, an investor must buy them from a *stock broker* who is a member of the stock exchange.

The broker pays for the privilege of buying and selling stocks listed on the exchange by buying one or more seats. Brokers also buy and sell stocks not listed on the exchange but cannot do so on the floor of the exchange.

The charge made by members of the exchange for buying and selling depends on the selling price of the stock. The rates are as follows:

COMMISSION RATES AND TRANSFER TAXES

New York Stock Exchange

Commission rates charged by the New York Stock Exchange are generally the model for the other leading national security exchanges.

On stocks selling at 50 cents per share and above, commission rates are based upon the amount of money involved in a single transaction and shall be not less than the following:

1. On each single transaction not exceeding 100 shares, in a unit of trading; a combination of units of trading; or a combination of a unit or units plus an odd lot:

Money Value	*Commission*
First $ 100.00	6%
$ 100.00 to 999.99	1% + $ 5.00
$1000.00 to 3999.99	1/2% + 10.00
$4000.00 and above	1/10% + 26.00

2. On odd lots (less than a unit of trading): Same as above, less 10%.

Minimum—Notwithstanding the above, when the amount involved is less than $15, as mutually agreed; $15 or more but less than $100, 6% of amount; and $100 or more, not exceeding 50 cents a share but not less than $6.

On stocks selling below 50 cents per share, the commission rate per 100 shares has been ruled to be not less than the following:

Price Per Share	*Rate Per 100 Shares*
1/256 of $1	$0.10
1/128 of $1	0.15
1/64 of $1 but under 2/32 of $1	0.50
2/32 of $1	0.50
Over 2/32 of $1 but under 8/32 of $1	1.00
8/32 of $1 but under 1/2 of $1	2.00

Minimum—Notwithstanding the above, when the amount is less than $15, as mutually agreed; $15 or more but less than $100. 6% of amount or rate per share, whichever is greater, and $100 or more, $6 or rate per share, whichever is greater.

Commission Rate Table

Share Sells at	*Rate per 100 Shs*		*Share Sells at*	*Rate per 100 Shs*	
	†NYS	*NYC*		*†NYS*	*NYC*
$ 1	$ 6.00	$ 7.00	$13	$16.50	$17.75
2	7.00	8.00	14	17.00	18.00
3	8.00	9.00	15	17.50	18.25
4	9.00	10.00	16	18.00	18.50
5	10.00	11.50	17	18.50	18.75
6	11.00	12.50	18	19.00	19.00
7	12.00	13.50	19	19.50	19.25
8	13.00	15.00	20	20.00	19.50
9	14.00	16.00	21	20.50	19.75
10	15.00	17.00	22	21.00	20.00
11	15.50	17.25	23	21.50	20.25
12	16.00	17.50	24	22.00	20.50

Share Sells at	*Rate per 100 Shs*	
	†NYS	*NYC*
$25	$22.50	$20.75
30	25.00	22.00
35	27.50	23.25
40	30.00	24.50
45	30.50	25.75
50	31.00	27.00
60	32.00	29.50
70	33.00	32.00
$ 80	$34.00	$34.50
90	35.00	37.00
100	36.00	39.50
125	38.50	45.75
150	41.00	‡50.00
175	43.50	‡50.00
200	46.00	‡50.00
250	50.00	‡50.00

† Rate applicable to unit lots only.

‡ $50 per 100 share rate applicable.

New York Curb Exchange

On stocks selling at 50 cents per share and above, the commission rate per share has been ruled to be not less than the following:

Price Per Share	*Rate Per 100 Shares*
1/2 but under $1	$ 5.00
$1 but under $2	7.00
$2 but under $3	8.00
$3 but under $4	9.00
$4 but under $5	10.00
$5 but under $6	11.50
$6 but under $7	$12.50
$7 but under $8	13.50
$8 but under $9	15.00
$9 but under $10	16.00
At $10	17.00
$10 but under $142	†
$142 and above	50.00

† $14.50 plus 1/4 of 1% of the total amount involved in the transaction.

Note: For stocks selling above $10 up to and including $142 per share, the rate may be computed by adding $58 to the price per share and dividing the result by 4. An amount in the final figure of less than 5 mills should be disregarded; for 5 or more mills, add 1c.

On stocks selling below 50 cents per share, the commission rates are the same as shown for the New York Stock Exchange.

Minimum—Same as shown for New York Stock Exchange for shares selling below 50 cents per share.

Other Stock Exchanges

Commission rates on the Midwest, Philadelphia-Baltimore, Pittsburgh and San Francisco Stock Exchanges are the same as the New York Stock Exchange. Rates on the Boston, Detroit and Los Angeles Exchanges also are the same with the exception of certain minimum rates.

TRANSFER TAXES

Transfer taxes are paid by the seller and depend on the selling price per share and/or the par value. No par value stocks are considered the same as $100 par. Odd lot purchases are usually subject to the same Federal transfer tax as is normally charged against the seller. Transfer taxes are imposed by the Federal Government and by the states of New York, Pennsylvania and Massachusetts, as follows:

Federal Transfer Taxes

$0.05 per $100 of total par value, selling under $20
$0.06 per $100 of total par value, selling above $20

State Transfer Taxes

New York—$0.01 per share under $5
$0.02 per share between $5 and $10
$0.03 per share between $10 and $20
$0.04 per share over $20
Massachusetts.............. $0.02 per $100 of total par value.
Pennsylvania................ $0.02 per $100 of market value, not exceeding, however, $0.02 per $100 of par value or per no par share.

In the following problems, use the commission rates of the New York Stock Exchange unless otherwise noted; also, use the "last" quotation in the list of selected quotations.

EXAMPLE 1. Mrs. Betty Ford buys 100 shares of Armour and Co. What is the commission charged by the broker?

SOLUTION. The last quotation is $11\frac{7}{8}$.

$$100 \times \$11\tfrac{7}{8} = \$1187.50, \text{ purchase price.}$$

This is a unit of trading, and the money value is between $1000 and $3999.99, so the commission rate is $\frac{1}{2}\%$ plus $10.00.

$$\tfrac{1}{2}\% \times \$1187.50 = \$5.94$$

$$\$5.94 + \$10.00 = \$15.94, \text{ brokerage.}$$

EXAMPLE 2. Mr. N. J. Paine buys 50 shares of Madison Square Garden. What is the brokerage fee?

SOLUTION. This is an odd lot.

$$50 \times \$8\tfrac{5}{8} = \$431.25, \text{ purchase price}$$

The money value is between $100 and $999.99, so the commission rate is 1% plus $5.

$$1\% \times \$431.25 = \$4.31$$

$$\$4.31 + \$5 = \$9.31.$$

Since this is an odd lot, we deduct 10%.

$$\$9.31 - \$.93 = \$8.38, \text{ brokerage.}$$

EXAMPLE 3. Mr. Berger buys 200 shares of a stock that sells at $14 per share. Using the commission rate table, find the brokerage.

SOLUTION. This is case of unit lots, so the table applies. Across from 14, we read $17.00. This is the brokerage for 100 shares.

$$2 \times \$17.00 = \$34.00, \text{ brokerage.}$$

EXAMPLE 4. Mr. Casey sells 300 shares of stock that have a par value of $50 per share and that sell for $60 per share. Compute the Federal transfer tax.

SOLUTION. Since the stock sells above $20, the tax rate is $0.06 per $100 of total par value. The total par value is 300 × $50 = $15,000.

15,000 ÷ 100 = 150, number of 100's.

150 × $0.06 = $9.00, Federal transfer tax.

Problems

1. Mrs. Anita Cooley buys 100 shares of Bethlehem Steel. What is the commission charged by the broker?

2. Mr. Zimmerman buys 50 shares of Standard Brands. What is the brokerage fee?

3. Mr. Goldstein buys 400 shares of a stock that sells for $3.00 per share. What is the commission charged?

4. Mr. Giordana buys 50 shares of Ohio Oil. Find the commission.

5. Mr. Colby buys 100 shares of a stock that sells for $5 per share, on the New York Curb Exchange. Find the commission.

6. Mr. Bundy buys 100 shares of a stock that sells for $12.50 per share, on the New York Curb Exchange. Compute the commission.

7. Mr. Wood sells 300 shares of a stock that sells for $12 per share. The par value is $10 per share. Find the Federal transfer tax.

8. Mr. Mulloy sells 500 shares of stock that sells for $15 per share. The par value is $10 per share. Find the Federal transfer tax and the New York state transfer tax.

UNIT 2

Bonds as an Investment

IN CHAPTER 10 we examined the savings account as a method of investment. As observed there, this method is used primarily by persons who demand safety and ability to deposit and withdraw at will. The interest rate, therefore, is usually small, and, since deposits are customarily limited to some set figure, this method of saving may not be open to one who has a larger sum to invest or desirable for one who wishes a higher rate of interest.

To such people another form of investment is open, that of *buying bonds.* One may purchase as many as one wishes, or is able to, and the rate of interest is nearly always higher than that given by a savings bank. This advantage is offset by the fact that withdrawals cannot be made at will, and, if cash is needed, the investor may be compelled to sell his bonds at a loss. Therefore one invests in bonds only that part of one's savings which is not immediately needed.

A *bond* is a secured credit instrument, under seal, which carries with it a promise to pay a specified sum of money within a fixed time and to pay interest at a fixed rate at regular intervals.

The most common bonds are *government*, *municipal*, and *corporation bonds.*

Bonds are designated by many different names, depending upon the source of the bond and the purpose for which the money is borrowed. The quotations published in newspapers give a good idea of the many different bond designations. Examples are "Amalgamated Sugar Co., 1st 7s, 1977"; "Denver, Col., water, 4½s, 1958"; "Farmers Mfg., 1st 7s, 1956"; and "U. S. Treas., 4s, 1944–54." Besides serving to identify the bonds, these designations tell who issued them, the interest rate, and the date on which the sum borrowed will be repaid. For instance, "City of Chicago Tax Relief Bonds" are bonds issued and sold by the City of Chicago to make up a deficit resulting from taxes not paid promptly, or within a certain time, by the taxpayers. The interest rate is indicated by the figure before the *s*. Thus, "7s" stands for "7% bonds."

The two principal kinds of bonds are *registered bonds* and *coupon bonds.*

Registered bonds are recorded on the records of the company or municipality that issues them. These records show the names and addresses of the owners, so that checks may be mailed to them when the interest becomes due.

Coupon bonds are bonds to which interest coupons are attached. When these interest coupons become due, they are detached by the owner of the bond and cashed like a check at the office of the issuing company or at a bank.

An illustration of a coupon bond is given on the following page.

Bonds are bought and sold through agents and brokers. Many banks act as agents for their depositors in the purchase and sale of bonds. Sometimes banking houses or bonding companies take over whole issues of bonds and sell them directly to their customers.

The rate of commission, or the brokerage fee, charged by brokers for buying and selling bonds for their customers is usually ⅛%, or 12½¢ per $100 of the par value of the bond, although in recent years these rates have been increased in some instances to ¼%, or 25¢ per $100. Most brokers have a minimum charge.

Bonds bear a definite rate of interest, which is payable at fixed intervals, usually annually or semiannually.

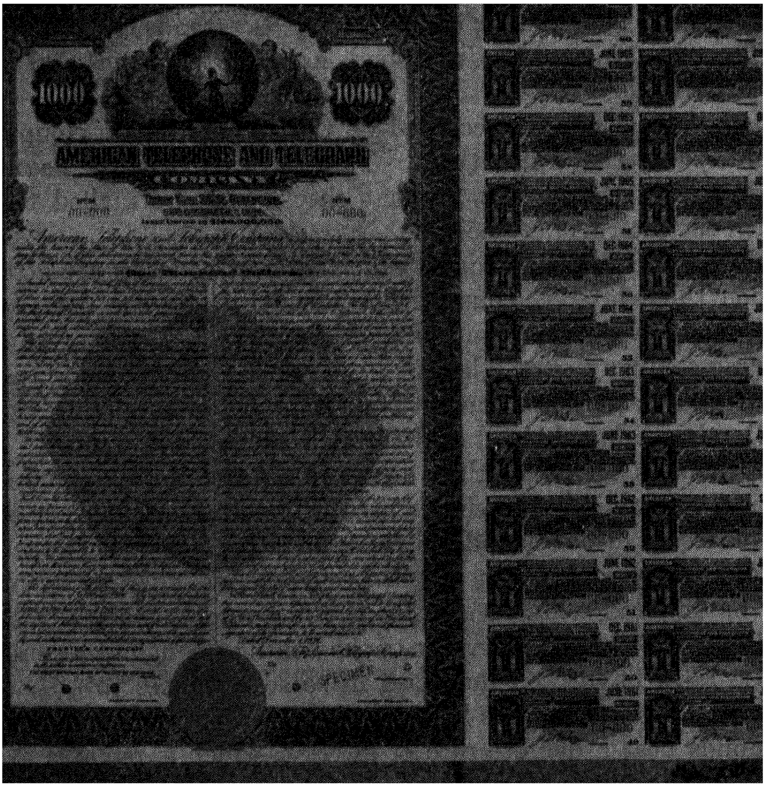
When bonds become due, they are usually paid at their face value. Sometimes, when the issuing company reserves the right to call its bonds before they are fully due, it will redeem them at a price higher than the face value.

A bond owner is a creditor of the municipality or corporation issuing the bond. Bonds are purchased usually for an investment. Bond quotations are given in daily papers and in financial publications.

Buying Bonds at a Premium

EXAMPLE 1. On Mar. 1 George Walton bought three $1000 bonds, bearing 6% interest payable Jan. 1 and July 1, at 102, including brokerage. Find the total cost, including accrued interest.

Before proceeding with the solution, certain *business expressions* must be explained. The $1000 referred to in the problem is the

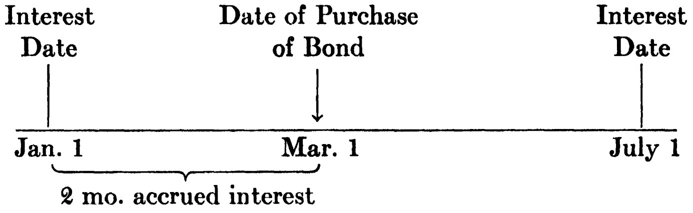


Coupon Bond.

par value, or the amount the borrower promises to pay the holder at maturity; the 102 is the *market price*, meaning $102 for a $100 bond, or $1020 for a $1000 bond. This price of $1020 is the price that one must pay to buy the bond, either from a bank or a broker. The reason why the price is higher than the par value may be the safety of the bond or its high rate of interest.

The interest dates in the problem are Jan. 1 and July 1. Therefore, if a man decided to buy these bonds on Mar. 1, he is acquiring the bonds 2 mo. after Jan. 1, and, during that time, the bonds have earned interest. Obviously, the man who held the bonds from Jan. 1 to Mar. 1 is entitled to the interest earned for that period, since the buyer of the bonds, at the next interest payment period, July 1, will receive from the issuing company the full amount of interest for the 6 mo. The interest earned but not received is known as *accrued interest*, and the buyer of the bonds must refund it to the seller.

The diagram below will help you visualize this explanation.



SOLUTION.

Price of one bond, including brokerage = $1020
3 × $1020 = $3060, price of three bonds.
Accrued interest on $3000 for 2 mo. at 6% = $30
$3060 + $30 = $3090, total cost of three bonds.

Note that the amount paid above the face value, $60, is called the *premium*, and that the company that pays the interest on the bonds computes it on the par value ($3000) and not on the market value ($3060).

Buying Bonds at a Discount

EXAMPLE 2. On Oct. 1 Richard Grange bought two $1000 bonds, bearing interest at 6% payable Jan. 1 and July 1, at 98. Brokerage was $2.50 per bond. Find the cost, including accrued interest.

The amount paid below the par value, $20, is called the *discount*.

SOLUTION.

Price of one bond = $980
2 × $980 = $1960, price of two bonds.
Accrued interest on $2000 for 3 mo. at 6% = $30
2 × $2.50 = $5, brokerage.
$1960 + $30 + $5 = $1995, total cost of bonds.

Of the total amount paid, the seller receives $1990 and the broker receives $5.

Investment to Yield a Desired Income

EXAMPLE 3. The first-mortgage 5% bonds of the Universal Manufacturing Corporation are selling at 75, including brokerage. How much must Arnold Johnson invest in these bonds if he wishes to have an annual income of $3000?

SOLUTION.

Interest on $1000 for 1 yr. at 5% = $50
$3000 ÷ $50 = 60, number of bonds needed.
60 × $750 = $45,000, investment required.

PROOF.

Interest on one $1000 bond = $50
$50 × 60 = $3000, income desired.

Chapter Test—Review

GROUP 1

Find the cost of the following $1000 bonds at the indicated prices, which include brokerage:

1. Two Patchen Ry. 4s at 105.
2. Six Smiles Co. 5s at 115.
3. Four Empire Film 4s at 92.
4. Ten Danish Bakers 3½s at 97½.

Find the brokerage on each of the following:

	Market Price of Bonds	*Brokerage*		*Market Price of Bonds*	*Brokerage*
5.	$5050	¼%	6.	$3075	$2.50 per bond

Find the accrued interest on the following groups of $1000 bonds:

	Number of Bonds	*Interest Rate*	*Interest Dates*	*Date of Purchase*
7.	2	6%	Jan. 1 and July 1	Mar. 1
8.	3	5%	Jan. 1 and July 1	Apr. 1
9.	4	4½%	Jan. 1 and July 1	Oct. 1
10.	5	6%	Apr. 1 and Oct. 1	Aug. 1

GROUP 2

1. On July 6 Jack Winthrop bought two $1000 4% Dairyland bonds at 93½. The interest was payable semiannually (on Apr. 1 and Oct. 1). If the broker charged a commission of $2.50 per $1000, how much was the total cost, including the accrued interest?

2. Majestic 5% bonds are quoted on Dec. 15 at 82¼. Interest is payable semiannually (Jan. 1 and July 1). Brokerage is $2.50 per bond. (*a*) Find the purchase price of ten $1000 bonds. (*b*) Find the proceeds to the seller.

3. The face of a bond is $1000, and the rate of interest is 4½% payable annually on Mar. 1. The market value on June 10 is 83¼. Find the cost of 75 of these bonds if brokerage is ⅛%.

4. Robert Clarkson purchased Azure Carriage 4% bonds with a par value of $55,000 at 99¼ on May 2. The interest dates are Mar. 1 and Sept. 1. Brokerage is $2.50 per $1000 bond. (*a*) Find the total cost of the bonds. (*b*) Find the proceeds to the seller.

5. A commercial 5½% bond of $1000 is quoted by a bond house at 115 and accrued interest. Interest is paid Mar. 15 and Sept. 15. (*a*) What is the cost of two bonds purchased on May 1? (*b*) On Oct. 8?

6. L. A. Ward wishes to establish a trust fund for his son's education. Mr. Ward has the opportunity to buy gas and electric bonds ($1000 par value), bearing 4½% interest, at $717.50 each, or railroad bonds ($1000 par value), bearing 6% interest, at $1037.50. The brokerage would be $2.50 for each bond. (*a*) Which bond would be the better investment, and what would be the rate of income? (*b*) How much would Ward have to invest in these bonds to secure an annual income of $900?

7. A. H. Williamson, on retiring from business, invested a portion of his money as follows: $27,500 in 5½% bonds at 137½ and $25,000 in 4% bonds at 125. (In each case the brokerage was included in the purchase price.) (*a*) What was Williamson's total annual income from these bonds? (*b*) What per cent of income did Williamson receive on each investment?

8. The first-mortgage 4½% bonds of the Standard Utility Corporation are selling at 80 plus $2.50 brokerage. How much must John Stewart invest in these bonds if he wishes the investment to yield an annual income of $2250?

Speed Drills in Fundamentals

Test 17

Add horizontally and vertically:

	Payee	*Principal*	*Interest*	*Total*
1.	L. Hall	$ 250.00	$ 3.75	$____
2.	C. Walson	75.00	1.13	____
3.	J. Holmes	564.50	11.29	____
4.	T. Ryan	82.70	2.48	____
5.	J. Wilson	1372.00	27.44	____
6.	M. Allen	728.60	14.57	____
7.	C. Thurston	394.75	11.48	____
8–10.	Totals	$	$	$

11. $642\frac{1}{2}$ sq. ft.
$320\frac{1}{4}$ " "
185 " "
$452\frac{3}{4}$ " "
$345\frac{3}{4}$ " "

12. $289\frac{1}{2}$
$17\frac{3}{4}$
$164\frac{5}{8}$
$29\frac{7}{16}$
$38\frac{3}{8}$
$356\frac{1}{4}$

Subtract:

13. .816	**14.** 30.084	**15.** 81.602	**16.** 89.1
.407	7.6205	70.7146	2.625

Multiply:

17. $72 \times 3\frac{1}{4}$

18. $\frac{2}{3} \times \frac{4}{5}$

19. $37\frac{1}{2} \times 14\frac{2}{7}$

20. $\frac{3}{4} \times 591\frac{4}{5}$

21. 6748 × 102

22. $246\frac{3}{4} \times 96\frac{3}{4}$ (Use the four-step method.)

23. 28,500 × $2.25 per 250

24. 42,750 × 1.875 per 250

Divide:

25. $12 ÷ .025 **26.** 22.4 ÷ .06 **27.** 2.008 ÷ .4 **28.** 16.245 ÷ 2.5

Change to common fractions:

29. $12\frac{1}{2}$% **31.** $16\frac{2}{3}$% **33.** $83\frac{1}{3}$% **35.** 25%

30. 70% **32.** $87\frac{1}{2}$% **34.** .6% **36.** $66\frac{2}{3}$%

Find the missing per cent:

37. 100 increased to 200 is ____%.

38. 600 decreased to 400 is ____%.

39. 520 is what per cent more than 420?

40. An increase from 600 to 750 is an increase of ____%.

Change to decimals:

41. $\frac{1}{5}\%$ **42.** $2\frac{7}{8}\%$ **43.** $\frac{3}{4}$ **44.** $\frac{3}{4}\%$ **45.** $\frac{1}{16}\%$

Find interest on the following:

	Principal	*Time*	*Rate*	*Interest*
46.	$ 250	20 da.	4%	$____
47.	$ 900	120 da.	$4\frac{1}{2}\%$	____
48.	$1200	36 da.	5%	____
49.	$1500	150 da.	6%	____
50.	$ 175	15 da.	3%	____

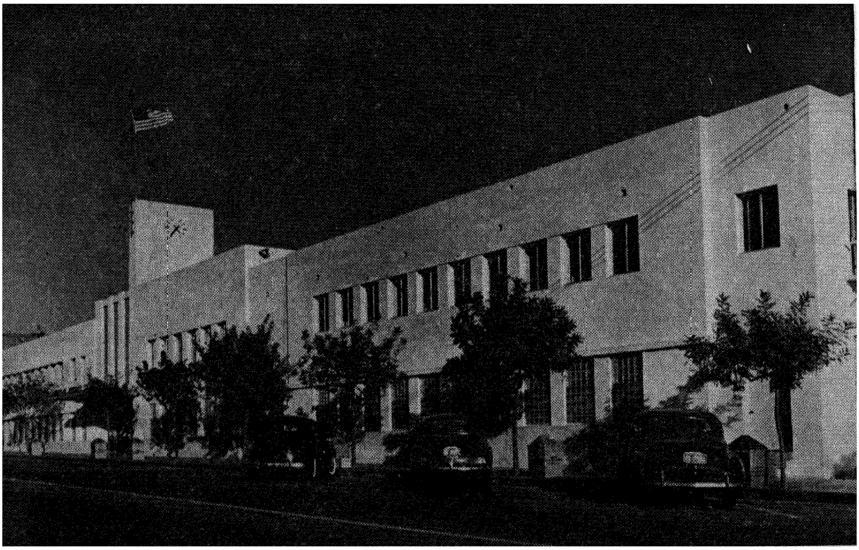
Chapter 22

Manufacturing

UNIT 1

Computing the Selling Price of Manufactured Articles

First, let us make clear the distinction between merchandising and manufacturing concerns. The merchandising house, whether wholesale, jobbing, or retailing, earns its income by buying a finished product and reselling it at a profit. The people it employs do not in any way change the article purchased; neither the man who buys it, the clerk who receives it, the salesman who sells it, the office clerk who records it, the cashier who receives the cash for it, nor anyone else connected with the organization in any way changes the actual product. It has merely changed hands, and, in being

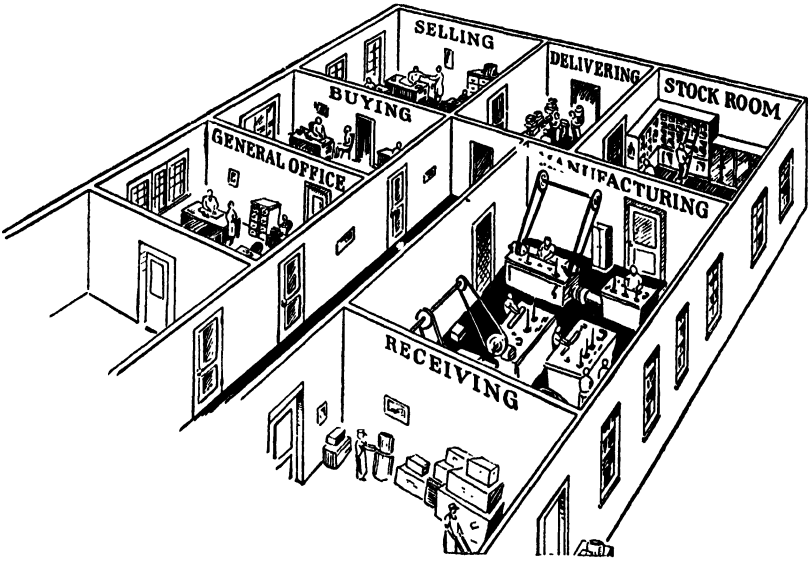


Courtesy Douglas Aircraft Co.

Administrative Offices of a Factory.

transferred from one firm to another and from the retailer to the consumer, the only change is in its price.

The manufacturer, on the other hand, makes very definite changes. If he happens to be a shoe manufacturer, he buys tanned leather by the skin, which he cuts, shapes, and dyes into shoes. If he is an automobile manufacturer, he buys steel, glass, rubber, and countless other commodities, and combines them all into an automobile. If he is a clothing manufacturer, he changes the cloth he has bought into suits, dresses, and coats; and, if he makes silverware, he turns shapeless bars of silver into pieces used in the home.



No matter what he produces, the manufacturer makes a definite change in the merchandise he has bought, and, when he has finished, the completed product bears only the faintest resemblance, if any, to the original material.

The manufacturer, like the wholesaler or retailer, has a buying staff, a selling force, and an office organization, all staffed by employees; but, in addition, he has what is known as a *manufacturing department.* It is this group of people doing the manual work, turning the raw materials into a finished product, which distinguishes the manufacturer from the merchant. Since, obviously, the cost of this labor enters into the price of the finished product, the calculation of this cost is a necessary part of determining the manufacturer's selling price; and, since his selling price is the cost price of the consumer, it interests all of us.

Finding the Selling Price of a Manufactured Article

Let us observe how the selling price of a manufacturered article is computed in a practical situation.

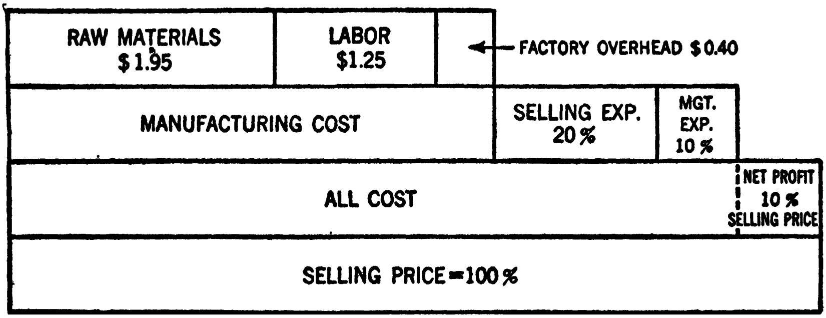
EXAMPLE 1. The Century Shoe Manufacturing Company, in producing 100 pairs of shoes, incurred the following costs: Materials and trimmings, $200; direct labor, $240; factory overhead, $360. The selling expenses will be $150, and the management expenses will be $125. If a profit of $1.50 per pair is desired, what will be the selling price of one pair of shoes?

SOLUTION.

Materials and trimmings	$ 200
Direct labor	240
Factory overhead	360
Selling expenses	150
Management expenses	125
Profit	150
	$1225, selling price of 100 pairs.

$1225 ÷ 100 = $12.25, selling price of one pair.

In Example 1 we had definite information as to just how much the selling expenses and the management expenses were for the *number* of shoes manufactured, but usually this is not the case. It would be next to impossible to be able to tell, for instance, how much of the office expense or how much of the sales manager's time should apply to a certain number of pairs. However, from a study of the statement of profit and loss, the manufacturer computes the percentages of the various expense items based on the net sales,



and, with such information, he can tell how much to charge against any number of pairs of shoes.

Example 2. The Century Shoe Manufacturing Company is asked to submit a price on children's shoes according to specifications. Analysis shows that each pair will cost as follows: Leather and trimming, $1.95; labor, $1.25; factory overhead, $.40. If the selling expenses are 20% of sales, the management expenses are 10% of sales, and the desired net profit is 10% of sales, what price will be quoted for one pair?

Solution.

Leather and trimming. . $1.95
Labor. 1.25
Factory overhead. 40
$3.60, cost of manufacturing.

Selling price is unknown and, therefore, 100%.

Sales expense. . . . . .20% of sales
Management expense. . .10% of sales
Net profit. . . . . .10% of sales
40%, total expense plus net profit.

100% − 40% = 60%, cost of manufacturing.
$3.60 = 60% of selling price
$3.60 ÷ 60% = $6, selling price of one pair.

Proof.

20% of $6 = $1.20, selling expense.
10% of $6 = .60, management expense.
10% of $6 = .60, net profit.
$2.40, total expense plus net profit.
$3.60 + $2.40 = $6.00, selling price.

Problems

Group 1

1. The cost of manufacturing a coat is $14.50. Selling and management expenses are $2.75. At what price must the garment be sold in order to realize a profit of $1.75?

2. The cost of producing a fountain pen is 24¢. The manufacturer calculates that, if he makes a gross profit of 20% on the selling price, he will earn sufficient money to pay for his operating expenses and leave a satisfactory net profit. At what price must he sell the pen?

3. A factory produces ten radios a day. The cost of manufacturing all of these instruments is $97.50. The owner estimates his selling and management expenses to be $1.25 per radio. If he wishes to make a net profit of $1 on each instrument, at what price must he sell it?

4. The cost records of a silk manufacturer disclose that the cost of manufacturing 1 yd. of No. 2 quality cloth is as follows: Raw silk, 25¢; labor, 15¢; factory overhead, 10¢. If he wants to make a gross profit of 10% on his manufacturing cost, at what price must he sell a yard of cloth?

5. If the manufacturer in Problem 4 sells a yard of silk at the price he asks, what percentage of profit has he made on his selling price?

6. A publisher figures that it costs him $125 to produce 100 books. He estimates his expenditures for advertising, royalties, and other expenses to be $50 per hundred books. What price must he charge for ten books if he wishes to make 25¢ on a book?

GROUP 2

1. You are told that the cost of manufacturing and selling a chair is as follows: Raw material, $4.64; labor, $2.48; factory overhead, $1.86; selling and other expense, $.83. The manufacturer wants to make a net profit of 10% on his sales. At what price should he sell a chair?

2. The *ABC* Corporation's records show that the cost of manufacturing 25,000 units of its product is $69,750. Selling and management expenses amount to $1.28 per unit. If the corporation desires to earn a net profit of $1.65 on each unit, at what price must each unit be sold?

3. The Fidelity Manufacturing Corporation manufactures a one-price electric heater. During the past year, 23,000 heaters were produced. The corporation's manufacturing, trading, and profit and loss statement discloses the following: Cost of manufacturing, $57,340; selling expenses, 15% of sales; general and other expenses, 15% of sales; net profit, 10% of sales. For how much did each heater sell?

4. The cost of manufacturing a radio receiving set is as follows: Material, $28.80; labor, $34.60; factory overhead, $2.40. At what price must it be sold to make a gross profit of 50% of manufacturing cost and allow 25% of selling price for advertising?

5. A man paid $26.25 for a chair. The retailer sold it to him at 40% profit on cost; the jobber sold it to the retailer at 25% profit on cost; and the manufacturer sold it to the jobber at 25% profit on cost. How much more than the manufacturer's cost did the consumer pay?

UNIT 2

Manufacturing Costs

JUST as merchandising firms determine the trend of their costs and their expenses by comparing statements of profit and loss for various periods, so do manufacturers, but the latter include in their analyses figures peculiar to their business—*manufacturing costs.*

Since these costs determine to a very large extent what selling prices and profits will be, the importance of such analyses is obvious. Let us see what information is vital.

Manufacturing Costs

EXAMPLE 1. The records of the Century Shoe Manufacturing Company show that the cost of manufacturing 100 pairs of shoes includes the following: Materials and trimmings, $400; labor, $240; and factory overhead, $160. What is the total cost of manufacturing?

SOLUTION.

Raw materials and trimmings	$400
Labor	$240
Factory overhead	$160
	$800, total cost of manufacturing.

This information, however, cannot be compared to that of previous periods, since the number and style of shoes produced each time is likely to vary. We can, however, find out whether the *proportion* of each of the three items to the total manufacturing cost has changed.

Percentage of Various Elements of Manufacturing Cost

EXAMPLE 2. What is the percentage of each of the various elements of cost in Example 1, based on the total manufacturing cost?

SOLUTION.

$$\frac{\text{Raw materials} \quad \$400}{\text{Total manufacturing cost} \quad \$800} = 50\% \text{ of manufacturing cost}$$

$$\frac{\text{Labor cost} \quad \$240}{\text{Total manufacturing cost} \quad \$800} = 30\% \text{ of manufacturing cost}$$

$$\frac{\text{Factory overhead cost} \quad \$160}{\text{Total manufacturing cost} \quad \$800} = 20\% \text{ of manufacturing cost}$$

Knowing, for instance, that raw materials are 50% of the manufacturing cost this period and 53% last period, we see that the cost this period has dropped; but, if the 30% labor cost this period is 8% higher than that of the last period, it will mean that the labor cost has risen, and an investigation may be necessary.

Another method of comparison is to compare the cost of one unit or job this period with the cost of a similar unit or job in the past.

Finding the Average Cost of Manufacturing One Unit

EXAMPLE 3. What is the cost of manufacturing one pair of shoes in Example 1?

Solution.

$$\begin{array}{l}\text{Cost of manufacturing}\\ \text{Pairs of shoes manufactured}\end{array}\ \frac{\$800}{100} = \$8.00\text{, cost of manufacturing one pair.}$$

We can now compare the cost of manufacturing one pair in this period with the cost of manufacturing one similar pair in previous periods and thus see whether the cost is rising or falling.

Problems

Group 1

1. A cost sheet contains the following: Raw materials, $150; labor, $100; factory overhead expense, $50. What is the cost of manufacturing?

2. What is the percentage of each item of cost in Problem 1 based on the cost of manufacturing?

Using last year's cost of manufacturing as the base, state the percentage of increase or decrease in each of the following items of cost:

Item	*Last Year*	*This Year*
3. Cost of Manufacturing........	$100	$150
4. Raw Materials...............	$ 50	$ 60
5. Labor.......................	$ 35	$ 60
6. Factory Overhead Expense....	$ 15	$ 30

7. The cost of manufacturing 100 pencils is $2.50. How much will six pencils cost?

8. The cost percentages for a certain company during the past year were as follows: Raw materials, 30%; labor, 60%; and factory overhead, 10%. What amount was expended for each item if the total manufacturing cost was $45,000?

9. During a certain year the Fairview Manufacturing Company produced 100 instruments at a cost of $42,500. During the next year it manufactured 200 instruments at a cost of $86,000. To what extent did the cost of manufacture of each instrument change?

Group 2

1. The books of account of the Greentree Mill Corporation show that the cost of manufacturing lumber consists of the following: Raw materials, $66,109.83; labor, $34,690.23; manufacturing overhead, $18,601.64. Compute the total cost of manufacturing.

2. Calculate the percentage that each element of cost bears to the total manufacturing cost in Problem 1. (Carry your answer to four decimal places.)

3. Percentages of manufacturing cost of the Ironclad Steel Corporation for the year are as follows: Raw materials, 47%; labor, 35%; manufacturing overhead, 18%. How much has been expended for each item if the total manufacturing cost is $87,500?

4. Raw materials, labor, and manufacturing overhead expenditures of a certain company amounted to $107,486 during a period in which 63,000 units were manufactured. How much did each unit cost?

5. Determine how much more or less it costs to manufacture a bicycle this year than it did last year, using the following statistics as a basis:

	Last Year	*This Year*
Number of Bicycles	22,000	36,000
Raw Materials	$120,000	$175,000
Labor	80,000	110,000
Manufacturing Expense	40,020	55,200

UNIT 3

Depreciation

WHEN we were discussing the topic of profit and loss, we found that the businessman, in order to calculate the selling price of the articles he sells, adds the purchase price to the expenses of the business, and then includes a profit for himself. The purchase price needs no discussion, and we have already devoted much of our time to computing the profit and the selling price. Expenses seem easy enough to compute, and yet there is one important item that may easily be overlooked.

In computing expenses for an office, all that is necessary is to add such items as rent, salaries, telephone, electricity, and commissions. These expenses appear frequently, payment is made for them directly, and they are disposed of. In a manufacturing business all these expenses exist, but there are others also. One of these other expenses will be explained now.

Let us take, for example, a machine for cutting leather for shoes. When it is bought, it is paid for, and no further payments are necessary, except for incidental repairs, until it wears out or becomes obsolete and a new one is bought. However, the cost of the machine cannot be included as an expense of the period in which it is purchased, since, obviously, it will also be used in later years, and during its whole life each day of use in the plant helps to wear it away and lessen its value. Therefore it is only fair that each business period be charged with this reduction in value, or expense. This expense, known as *depreciation*, can be calculated in several ways. Depreciation applies to items other than factory machines —for example, office desks, typewriters, automobiles, buildings, and so on.

Appraisal Method

Example 1. The bookkeeper of J. Banks has calculated the profit for the year to be $1000, but he has neglected to take depreciation into consideration. A machine which had been purchased at the beginning of the year for $12,000 is estimated to be worth only $10,500 at the end of the year. What is the true profit or loss for the year?

Solution.

Value of machine at beginning of year..	$12,000
Less value of machine at end of year...	$10,500
	$ 1500, depreciation.
Less profit as computed...............	$ 1000
	$ 500, net loss for year.

It is obvious, then, that it is very important that depreciation be included in all calculations of expense. The method used here is the *appraisal method.*

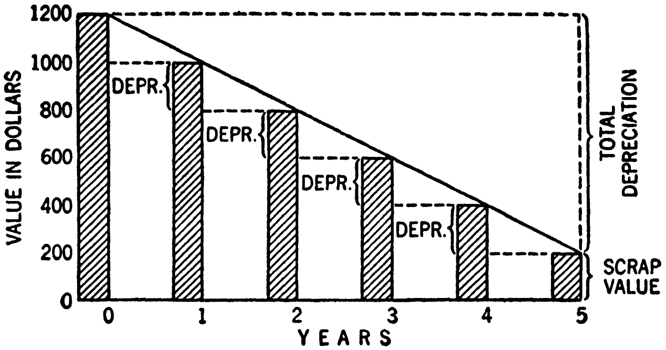
Straight-Line Method

Another simple and very common way of computing depreciation is to assume that the rate will be the same for each year. All that is necessary is to take the cost price, subtract the estimated scrap value, and then divide the remainder by the number of years it is expected to be used. The result is the average annual depreciation. Expressed as an equation, it is

$$\frac{\text{Cost minus scrap value}}{\text{Estimated life}} = \text{Annual depreciation}$$

To find the annual rate of depreciation, divide the annual depreciation by the cost of the machine.

Example 2. The Century Shoe Manufacturing Company bought a machine for $1200. It is estimated that it will be used for 5 years, at the end of which time it will be sold for scrap or traded in, and that $200 will then be obtained for it. What is the annual rate of depreciation?



Solution.

Cost of machine	$1200
Less scrap value	$ 200
	$1000, total depreciation.

$1000 ÷ 5 = $200, annual depreciation.

$200 ÷ $1200 = $16\frac{2}{3}\%$, annual rate of depreciation.

Example 3. Find the book value of the Century Shoe Manufacturing Company machine in Example 2 at the end of the third year. (The *book value* means the cost of the machine at the time it was bought, less all the depreciation that has been charged against it.)

Solution.

Cost	$1200
Less depreciation during first year	$ 200
	$1000, book value at end of first year.
Less depreciation during second year	$ 200
	$ 800, book value at end of second year.
Less depreciation during third year	$ 200
	$ 600, book value at end of third year.

Declining-Value Method

Under the declining-value method of calculating depreciation, the amount of depreciation is not the same each year. On the basis of past experience, a company may decide, for example, that a machine depreciates 20% each year. This does not mean 20% of the value of the machine when it was bought, but 20% of the value of the machine *at the end of the preceding year*. Thus, the depreciation for the second year will be 20% of the difference between the cost of the machine and the depreciation of the first year.

Example 4. The Century Shoe Manufacturing Company bought a machine for $1200. On the basis of past experience, it is estimated that the machine will depreciate at the rate of 20% on the declining value. What will be the book value of the machine at the end of 3 years?

Solution.

Book value at beginning of first year	$1200.00
Less 20%	$ 240.00
	$ 960.00, book value at end of first year.
Less 20%	$ 192.00
	$ 768.00, book value at end of second year.
Less 20%	$ 153.60
	$ 614.40, book value at end of third year.

Sum of the Years' Digits Method

A new method of computing depreciation is currently used quite extensively. It is permitted by income tax laws.

The method will be illustrated by an example.

Example. A machine costs $4000 and depreciates to a scrap value of $500 in 4 years. Find the depreciation charge each year by the sum of the years' digits method and construct a depreciation schedule.

Solution. $1 + 2 + 3 + 4 = 10$. The depreciation charge for each year is:

First year, $\frac{4}{10}$ of $3500.
Second year, $\frac{3}{10}$ of $3500.
Third year, $\frac{2}{10}$ of $3500.
Fourth year, $\frac{1}{10}$ of $3500.

Notice that $\frac{4}{10} + \frac{3}{10} + \frac{2}{10} + \frac{1}{10} = \frac{10}{10} = 1$.

DEPRECIATION SCHEDULE

Year	Depreciation Charge	Amount in Depreciation Fund	Book Value
0	0	0	$4000
1	$1400	$1400	2600
2	1050	2450	1550
3	700	3150	850
4	350	3500	500

Observe that this method counts more depreciation in the early years of the object being depreciated. In this respect it is like the declining-value method. It is very easy to calculate, and will probably become a popular method of computing depreciation.

Problems

GROUP 1

1. Your employer informs you that since the beginning of the year, when he purchased the firm's automobile, it has decreased 40% in value. If the purchase price was $2400, how much has the automobile depreciated?

2. The Zenith Appliance Company has just purchased a new power drill for $600. At the end of its estimated life of 10 years the machine will have no value. If the straight-line method is used, how much depreciation will have been written off at the end of the third year?

3. The Atlas Tool Company has installed a new die press at a cost of $600. The productive life of the press is estimated to be 5 years, at the close of which the scrap value of the machine will be $50. What will be the book value of the machine at the end of 1 year?

4. The depreciation charges for the past 5 years on the books of account of the Steam Shovel Corporation are $250, $250, $500, $500, and $600. The purchase prices of its equipment total $6000. Calculate the present book value of the equipment.

5. The productive efficiency of a certain machine is greatest during the early years of its life. Assume that its cost is $1000 and that it depreciates at the rate of 10% of the balance at the beginning of each year. What amount should the bookkeeper deduct as the annual depreciation charge at the end of the second year?

6. A building is valued at $60,000. It is estimated that it will depreciate to a value of $10,000 in 20 years. Using the sum of the years' digits method, what is the depreciation charge for the first year?

7. A machine is valued at $12,000 and will depreciate to a value of $2,000 in 10 years. Using the sum of the years' digits method, construct the depreciation schedule for the first four years.

8. An automobile costs $4,000 and will depreciate to $800 in five years. Use the sum of the years' digits method to construct a depreciation schedule.

9. Derive a formula for the sum of the first n whole numbers. Thus, $1 + 2 = 3$; $1 + 2 + 3 = 6$; $1 + 2 + 3 + 4 + 5 = 15$; and so forth. Use your formula to find the value of $1 + 2 + 3 + \ldots + 20$, and check by adding the numbers.

GROUP 2

1. Machinery that cost $128,000 is inventoried at the end of 10 years at $96,000. What is the average per cent of annual depreciation on the cost of this machinery?

2. Machinery that cost $108,000 was valued at the end of 5 years at $89,600. (*a*) What was the average annual decrease in value? (*b*) What per cent of the cost of the machinery was the total depreciation? (*c*) What was the average per cent of annual depreciation on the cost?

3. The Wyoming Silk Mills purchased looms valued at $150,000. At the end of their useful life, these looms can be scrapped for $5000. If the estimated life of this equipment is 12 years, how much depreciation should be written off the books annually?

4. A maker of automobile tires estimated that his factory buildings would depreciate 4% each year and that his machinery would depreciate 10% each year. The buildings were valued at $800,000, and the machinery was valued at $1,500,000. Find the value of each at the end of the fourth year. (Calculate the depreciation each year on the original value.)

5. It is estimated that the depreciation on a particular machine amounts to 25% of the value of that machine at the beginning of each year. If it was purchased for $4500, what was its value at the end of the fourth year?

6. The Rubberoid Company purchased a machine 3½ years ago for $2540. Since then, 10% of the purchase price has been deducted each year as depreciation. The company now wishes to trade the machine in for a new one that is valued at $2755. The seller agrees to accept the old machine at its present book value, the balance to be paid in cash. How much cash must the company give in addition to the old machine?

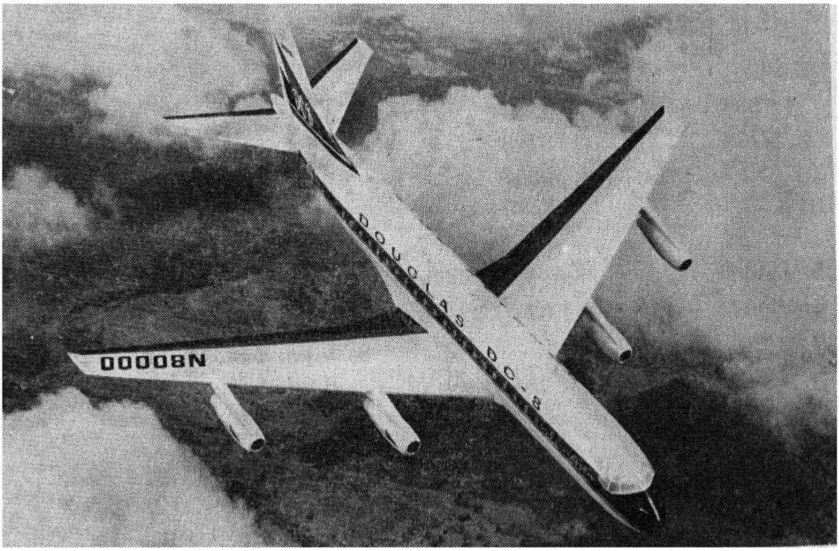
Chapter Test—Review

1. The cost of producing a radio is $21. The manufacturer calculates that, if he makes a gross profit of 25% on the selling price, he will be able to pay his operating expenses and earn his desired net profit. At what price must he sell the radio?

2. A cost sheet contains the following: Raw materials, $100; labor, $75; factory overhead expense, $40. What is the cost of manufacturing?

3. The Barco Printing Company installed a new die press at a cost of $500. Its productive life is 5 years, at the end of which the scrap value of the machine will be $40. What will be the book value at the end of 1 year?

4. In producing 50,000 pairs of shoes selling at $4.50 a pair, the costs were distributed as follows: Raw materials, $77,340; wages and salaries in production, $88,270; and factory overhead expenses, $21,165. (*a*) Find the manufacturing cost of one pair of shoes. (*b*) Find the gross profit on the 50,000 pairs. (*c*) What per cent of the whole manufacturing cost was the gross profit?



Courtesy of Douglas Aircraft Co.

Douglas DC-8. Building airplanes is an important manufacturing industry.

5. The costs of manufacturing 1000 ladies' coats were distributed as follows: Materials for use in production, $10,836; wages and salaries in production, $17,430; and overhead expenses, $1,288. The coats sold for $35 each. (*a*) Find the total manufacturing cost of the 1000 coats. (*b*) Find the cost of one coat. (*c*) What per cent of the manufacturing costs was the gross profit?

6. The Bermuda Knitting Mills purchased machinery valued at $100,000. At the end of its useful life, which is estimated to be 20 years, it will have a scrap value of $10,000. Find the annual rate of depreciation.

7. A manufacturing concern had the following costs in producing its product: Raw materials, \$85,300; wages, \$96,230; factory overhead, \$23,370. If 60,000 units that sold for \$5 each were produced, what is (*a*) the cost of one unit, (*b*) the gross profit of the entire 60,000 units, and (*c*) the per cent of gross profit to manufacturing cost?

8. The manufacturing statement of the Diamond Paint Company for the year shows the following: Raw materials, \$50,000; direct labor, \$35,000; factory overhead, \$12,500. During the following year, these amounts decreased as follows: Raw materials, \$2590; direct labor, \$2500; factory overhead, \$3090. Find the per cent of decrease in (*a*) each item of cost, and (*b*) total manufacturing cost for the second year.

Speed Drills in Fundamentals

Test 18

Add:

1. 968
732
687
543
929

2. 8564
3728
9643
7789
6927

3. $1\frac{2}{3}$
$3\frac{5}{8}$
$6\frac{5}{12}$
$7\frac{1}{2}$

4. $5\frac{7}{8}$
$4\frac{1}{2}$
$3\frac{5}{16}$
$7\frac{2}{3}$

5. 20.007 + 5.2 + .006 + 17.5065 + .0276

6. .00625 + 125.2 + 1.07 + 6 + 8.074

7. 8 lb. 6 oz.
5 lb. 8 oz.
3 lb. 14 oz.

8. 5 yd. 2 ft. 10 in.
6 yd. 1 ft. 8 in.
7 yd. 2 ft. 11 in.

Subtract:

9. 6542
2658

10. 18325
9457

11. 8
$3\frac{2}{3}$

12. $15\frac{3}{16}$
$5\frac{5}{8}$

13. 5.207
1.06204

14. 156
16.095

15. 12 bu. 2 pk.
8 bu. 3 pk.

16. 5 gal. 1 qt.
2 gal. 3 qt.

Multiply:

17. 6584
76

18. 5696
548

19. $5\frac{2}{3} \times 6\frac{3}{4}$

20. $18\frac{5}{16} \times 22\frac{7}{12}$

21. 5.09 × 6.004

22. 275.2 × .0255

23. 8 yd. 9 in.
12 in.

24. 8 pk. 3 qt. 1 pt.
9

Divide:

25. $24\overline{)16484}$ **28.** $24\frac{5}{6} \div 12\frac{1}{2}$ **31.** $5\overline{)6 \text{ yd. } 2 \text{ ft. } 10 \text{ in.}}$

26. $58\overline{)172690}$ **29.** $50.406 \div 24.2$ **32.** $1 \text{ pk. } 4 \text{ qt.}\overline{)24 \text{ pk.}}$

27. $8\frac{2}{3} \div 6\frac{1}{4}$ **30.** $420 \div .0004$

Express as improper fractions: *Express as mixed numbers:*

33. $6\frac{2}{3}$ **34.** $75\frac{3}{4}$ **35.** $\frac{25}{6}$ **36.** $\frac{24}{7}$

Express as decimal fractions. Round off to nearest hundredth:

37. $\frac{7}{13}$ **38.** $\frac{23}{25}$ **39.** $\frac{9}{15}$ **40.** $\frac{12}{35}$

Change to per cents:

41. $.0016\frac{2}{3}$ **42.** .008 **43.** $.12\frac{1}{2}$ **44.** $3\frac{1}{2}$

Complete:

45. 16% of 320 = ____. **47.** 20% of ____ is 80.

46. 18 is ____% of 90. **48.** 25% more than 140 = ____.

49. An increase from 20 to 40 is a ____% increase.

50. A decrease from 36 to 6 is a ____% decrease.

*

Chapter 23

Graphs

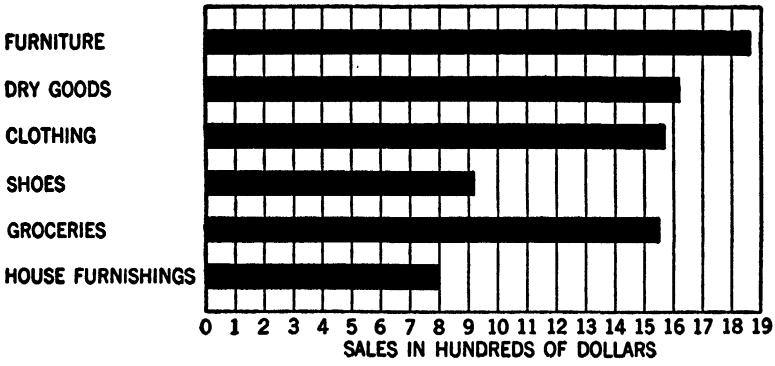
UNIT 1

Graphic Illustration of Business Records— Bar Graphs

WHEN business records are presented in actual detailed figures, they must be studied closely in order to be understood, and so another method has been evolved which makes larger trends visible almost at once. This result is accomplished by means of *graphs*, which enable one to see visually, almost immediately, what other records disclose only after inspection. That does not mean that business records in tabular form are too cumbersome, for they still retain their value for detailed analysis.

Bar Graph

EXAMPLE 1. The total sales of the various departments of the Highway Department Store for the week ending Sept. 17, 19—, were as follows: Furniture Department, $1856.95; Dry Goods Department, $1639.46;

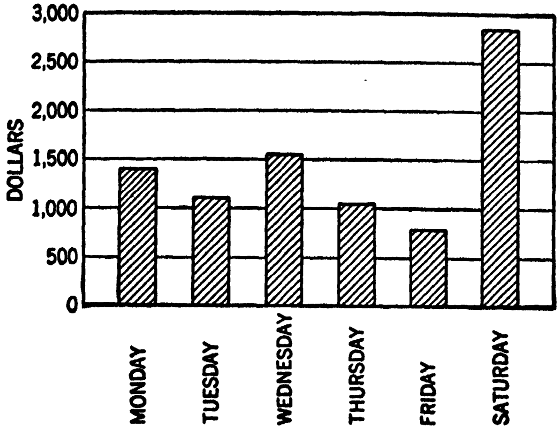


Departmental Sales of the Highway Department Store for the Week Ending Sept. 17, 19—.

Clothing Department, $1572.55; Shoe Department, $928.47; Groceries Department, $1547.45; House Furnishings Department, $819.73. Prepare a *bar graph* showing this information.

This illustration of a bar graph shows the sales in hundreds of dollars in the six departments of the Highway Department Store for the week ending Sept. 17, 19—. What is the key in this graph? What do the horizontal bars represent? What do the perpendicular divisions represent?

EXAMPLE 2. The total daily sales of the Highway Department Store for the week ending Sept. 17, 19—, were as follows: Monday, $1303.71; Tuesday, $1051.27; Wednesday, $1502.59; Thursday, $1003.32; Friday, $751.76; Saturday, $2751.98. Prepare a bar graph showing this information.



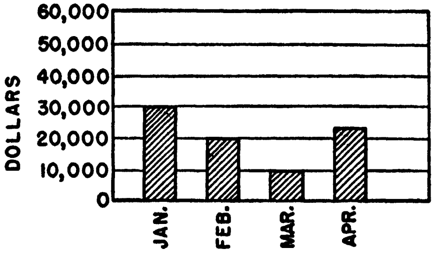
Daily Sales of the Highway Department Store for the Week Ending Sept. 17, 19—.

This illustration represents the total daily sales of the Highway Department Store for the week ending Sept. 17, 19—. From the zero point the two series of units, time in days and amounts in dollars, are arranged in progression, the amount progressing from zero upward along the perpendicular line and the time progressing from zero to the right along the horizontal line. The *time key* is 1 day, and the *amount key* is each horizontal section representing $500. What are the two units of measure in this graph? Why is it necessary to have a key to a graph?

Problems

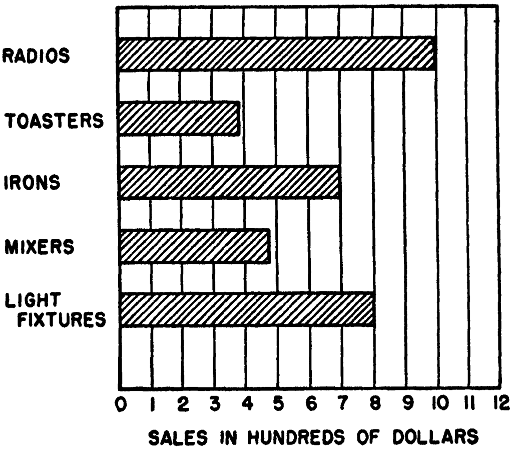
Group 1

1. Read the information contained in the following bar graph:



Monthly Sales of the Modern Hat Shop.

2. Read the information contained in the following bar graph:



Sales in the Electric Appliance Co. for the Week of March 10–15.

Group 2

1. The sales of a department store for the year were as follows: Groceries, \$58,400; shoes, \$63,200; clothing, \$73,500; furniture, \$81,000; dry goods, \$83,200; rugs and carpets, \$96,000. Show by a bar graph the comparative sales in the six different departments. Arrange the bars in the order of decreasing length.

2. The sales made by the six salesmen in the sales department of a certain company for the year were as follows:

J. H. Harris	$29,400	H. J. Moore	$63,700
O. E. Jackson	52,900	A. D. Evans	38,000
L. M. King	48,700	R. E. Hines	71,500

Show by a bar graph a comparison of the sales of the various salesmen.

3. The profit and loss statement of D. White for the year ending Dec. 31, 19—, showed the following: Net sales, $8000; cost of goods sold, $4800; operating expense, $2400; and net profit, $800. Reduce each item to its per cent of net sales and show the relative proportions by a bar graph or other graphic means.

UNIT 2

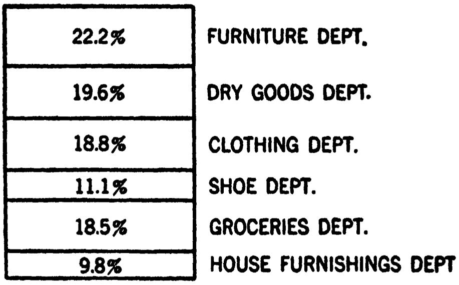
Graphic Illustration of Business Records— Rectangle and Circle Graphs

Unit 1 was concerned with the value of graphs in general and discussed in detail one particular type—bar graphs. In this lesson we shall discuss two additional kinds—*rectangle* and *circle* graphs—which may be used in a different way.

Bar graphs are useful in showing how two or more items or groups compare with each other. Rectangle and circle graphs, both of which are illustrated and explained below, may also be used for this purpose, but their main function is to show the relation of each part to the whole. Thus, if the departments in a store were being studied on a sales basis, a bar graph would show how the amounts of the sales of the various departments compared with one another. A rectangle or circle graph would show the relation of each department's sales to the total sales.

Rectangle Graph

Example 1. The sales of the Highway Department Store for the week ending Sept. 17, 19—, were distributed among the various departments as



Distribution of Sales of the Highway Department Store Among Departments for the Week Ending Sept. 17, 19—.

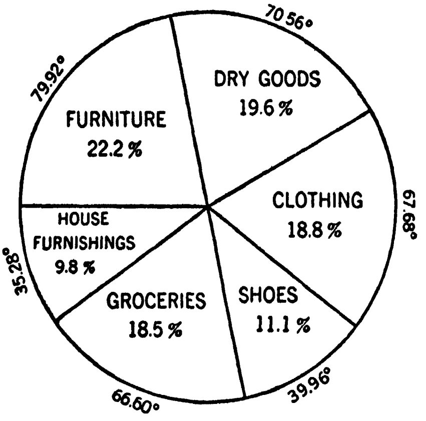
follows: Furniture Department, 22.2%; Dry Goods Department, 19.6%; Clothing Department, 18.8%; Shoe Department, 11.1%; Groceries Department, 18.5%; House Furnishings Department, 9.8%. Prepare a rectangle graph showing this information.

This illustration of a rectangle graph shows the sales of the various departments as percentages of the total weekly sales of the Highway Department Store.

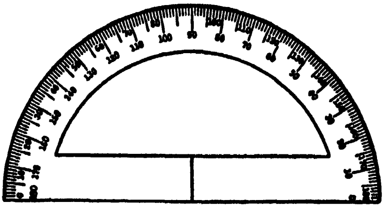
This graph shows the proportion of parts to the whole. Colors or crosshatching may be used to show the different parts of a rectangle graph.

Circle Graph

Example 2. Show in the form of a circle graph the same facts as were called for in Example 1.



Distribution of Sales of the Highway Department Store Among Departments for the Week Ending Sept. 17, 19—.



Protractor.

This graph may be prepared by using an ordinary protractor. The protractor shown to the right of the circle is divided on the basis of degrees. Since there are 360° in a circle, 100% is represented by 360°, 25% is represented by 90°, and so on.

In this graph the portion of the circle to be allotted to the sales of each of the various departments was determined in the following manner:

Furniture Department sales = 22.2% of 360° = 79.92°
Dry Goods Department sales = 19.6% of 360° = 70.56°
Clothing Department sales = 18.8% of 360° = 67.68°
Shoe Department sales = 11.1% of 360° = 39.96°
Groceries Department sales = 18.5% of 360° = 66.60°
House Furnishings Department sales = 9.8% of 360° = 35.38°
100% 360.00, or 360°

Problems

1. The sales of the Tason Shoe Manufacturing Company amounted to $150,000 for the year. The various items sold and the sales of each are listed below. Prepare a circle graph showing the relation of the sales of each item to the total sales. (Use a protractor.)

Item	*Sales*
Ladies' Kid Shoes	$25,000
Men's Crepe Soles	10,000
Men's Oxfords	30,000
Men's Slippers	15,000
Ladies' Slippers	10,000
Ladies' Sport Shoes	20,000
Ladies' Formal Shoes	12,500
Men's Patent Leather Shoes	12,500
Men's Hunting Shoes	15,000

2. A manufacturer of washing machines finds that he has the following expenses in making the finished product:

Direct Labor	$ 4000
Raw Materials	2000
Rent	1400
Indirect Labor	1600
Overhead	500
Depreciation of Machinery	300
Factory Supplies	200
Total Cost	$10,000

Show the relation of each of the above expenses to the total cost on a rectangle graph.

3. A railroad compiled the following figures for submission to the Interstate Commerce Commission:

Materials	$ 62,000
Insurance	19,000
Depreciation	22,000
Taxes	112,000
Power	92,000
Labor	514,000
Maintenance	222,000

Prepare a circle graph to show the relation among the various costs. (Use a protractor.)

UNIT 3

Business Records. Single-Curve and Comparative-Curve Graphs

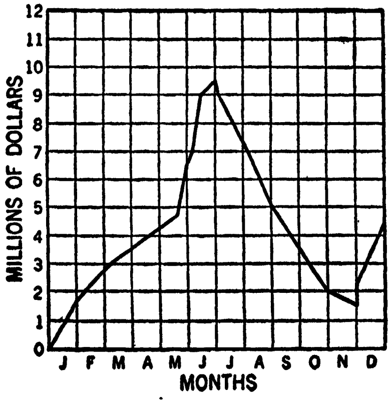
As WE have seen in Units 1 and 2, bar graphs are used mainly to show comparative size or number, and rectangle and circle graphs are used to show the relation of each element or part of some group to the entire group. In this unit two other types—single-curve and comparative-curve graphs—will be discussed.

These two graphs also show pictorially information that, if presented in detail numerically, would need much analysis in order to be understood. Whereas the graphs mentioned in the two preceding lessons compare component parts of a unit, or different units, these graphs show fluctuations in items over a given period of time. If, for instance, a store is interested in seeing how many customers are reached through a certain piece of advertising, a *single-curve graph* would be prepared to show how many customers came to the store before the advertisement was published, how many came while it was in effect, and how many came after it had been withdrawn.

Single-Curve Graph

This curve graph illustrates how sales are charted in an automobile business.

This illustration of a single-curve (broken-line) graph shows the fluctuation of automobile sales over a period of one year in a certain



territory. The sales range from 1¾ million dollars in January to 9½ million dollars in June.

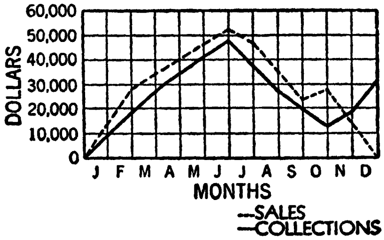
Each perpendicular section represents 1 million dollars, and each horizontal section represents 1 month of time.

Read the graph and give the approximate sales for each month of the year. Explain how the key is used in reading the graph.

In drawing a curve graph, use graph paper with ¼-inch squares. To draw the curve, place dots on the vertical lines at the proper intersections to represent the quantities. Then connect these dots by a line, using a ruler.

Comparative-Curve Graph

Sometimes a firm may wish to chart two related items over a period of time. For this purpose, a curve graph containing two curves instead of one is used. Such a graph is known as a *comparative-curve graph*, or a *multiple-line graph.*



Sales and Collections During the Year.

The comparative-curve graph shown in this illustration represents the relative amounts of collections and sales during each month of a year in a certain business. The upper curve represents sales, and the lower curve represents collections. In drawing comparative-curve graphs of your own, use a different color or a different kind of line for each curve.

It can be seen from the graph that the collections run a little behind the sales each month until December, when the collections run ahead of the sales. About how much were the sales each month? About how much were the collections each month?

Problems

1. Construct a multiple-line graph showing a comparison of the sales of the Roland Manufacturing Company for the first 2 years of its operation. (Use graph paper and a different color for each curve.)

	First Year	*Second Year*
January	$ 4250	$ 5000
February	3125	2325
March	2975	7000
April	5175	6750
May	4750	11,250
June	10,000	10,000
July	4750	8750
August	7750	4025
September	5400	2500
October	3250	5750
November	8025	6925
December	5500	8075

2. A merchant's yearly sales over a period of 10 years were as follows: $12,250, $15,500, $17,850, $21,375, $26,900, $31,280, $35,780, $32,300, $34,600, and $38,700. Prepare a graph to exhibit the changes year by year. (Use graph paper.)

3. The earnings and expenses of a certain utility corporation over a period of 6 years were as follows:

	1	*2*	*3*	*4*	*5*	*6*
Earnings	$380,000	$470,000	$550,000	$625,000	$750,000	$900,000
Expenses	310,000	390,000	420,000	500,000	600,000	720,000

Prepare a comparative-curve graph to show the relation between earnings and expenses. (Use graph paper.)

Courtesy Los Angeles Chamber of Commerce

Air View of Los Angeles.

Chapter Test—Review

1. Make a broken-line graph showing the index of business activity in Southern California for the years 1940–1956.

Year	*Index*	*Year*	*Index*
1940	104.5	1949	269.2
1941	130.2	1950	308.2
1942	153.9	1951	334.5
1943	194.5	1952	361.9
1944	211.4	1953	394.2
1945	215.9	1954	420.0*
1946	243.6	1955	450.0*
1947	261.4	1956	480.0*
1948	279.8		

---

* Estimated.

2. Construct a broken-line graph showing the annual mean temperature in Los Angeles for the years 1948–1956.

Year	*Annual Mean Temperature*
1948	63.0
1949	63.3
1950	63.8
1951	63.6
1952	63.6
1953	64.6
1954	64.2
1955	64.5
1956	63.8

3. Construct a vertical bar graph showing the areas of some of the leading cities.

City	*Area in Square Miles*
Los Angeles	454
New York	315
Chicago	207
New Orleans	199
Houston	160
Detroit	140
Philadelphia	127
Dallas	112
Memphis	104
San Diego	99

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